Literature review:
Obesity related to breast cancer risk in premenopausal women and which diet gives positive outcomes to reduce overall risk.

Research project:
Weight loss intervention trial comparing intermittent low carbohydrates versus continuous Mediterranean diet

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Declaration statement of own work:

This research paper has been produced solely by Sandra Todd and has not been copied by any other persons

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Abbreviations:

ILCD, intermittent low carbohydrate diet; DRMD, daily restricted Mediterranean diet; DER, daily energy restriction; FFM, fat free mass; FM, fat mass; BC, breast cancer; BMR, basal metabolic rate; BMI, body mass index; IGF, insulin- like growth factor; DHEAS, dehydroepiandrosterone sulphate; WC, waist circumference; HC, hip circumference; WHR, waist to hip ratio; RR, relative risk; BP, blood pressure; LOCF, last observation carried forward; IER, intermittent energy restriction; IECR + PF, intermittent energy and carbohydrate restriction + *ad libitum* protein; VLCD, very low calorie diet; CER, calorie energy restriction; LCD, low calorie diet; RCT, randomised clinical trial; SHBG, sex hormone- binding globulin; HR, Hazard Ratio; MUFA, monounsaturated fatty acids; PUFA, polyunsaturated fatty acids; ITT, Intention to treat

Literature review:

Obesity related to breast cancer risk in premenopausal and postmenopausal women and which diet gives positive outcomes to reduce overall risk.

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Abstract

Breast cancer (BC) is the most frequently diagnosed cancer amongst women in the UK accounting for 30.7% of cases in 2011, with 80% of new cases diagnosed at the age of fifty years and over (Office of National Statistics, 2011). Women who have the BRCA1 or BRCA2 gene have a 45%-90% lifetime risk of developing BC. Other genes (TP53 and PTEN) also significantly increase a woman's risk as well as more common genes that can also give a slightly increased risk of BC (Cancer Research UK, 2014). It is estimated that 27% of all cases in the UK could be prevented and linked to lifestyle and environmental factors (Parkin, Boyd & Walker, 2011).
An understanding in obesity connected to premenopausal and postmenopausal women and why conformity to the traditional Mediterranean diet may be associated to lowering breast cancer risk. Especially when combined with an intermittent dietary approach which may provide positive outcomes for weight loss, body composition and reduction in breast cancer risk.

Introduction

The global health burden of obesity- related breast cancer (BC) incidences may be reduced by weight loss and associated improvements in insulin sensitivity.

Effective dietary interventions are required to promote adherence long- term and the need to preserve lean body mass (Lovemann et al, 2011).

Breast cancer is the most frequently diagnosed cancer and cause of mortality among women since 1997. It is estimated 1.7 million new cases of which 27.7% are diagnosed in Europe (Steward & Wild, 2014), with age- standardised incidence rates higher in Western Europe (90 cases per 100,000 women each year) compared to the lowest in Eastern Asia (19 cases per 100,000 women). This figure has increased from 30,000 recorded in 1998 (DoH, 1998), and 1.5 million recorded in 2002 (WCRF, 2007). Breast cancer incidence rates are elevated in countries establishing the highest levels of human development and the most common cancer in women in the UK accounting for 30.7% of cases (41,523) in 2011. 80% of all new cases among women in 2011 were aged fifty years or over (Office of National Statistics, 2011), with a significant association ($P<0.01$) of body mass index (BMI) with age in women costing the healthcare. Accounting for each unit increase in BMI is associated with £16 higher annual healthcare cost. Those above BMI 20kg/m^2 compared to a BMI of 40kg/m^2 the costs more than doubles (over £300 to over £600 respectively) (Tigbe, Briggs, & Lean, 2012).

The purpose of this review will be looking at BC risk in women and the relationship towards obesity and nutrition. It is estimated 27% of all cases in the UK are linked to lifestyle and environmental factors such as alcohol consumption (6.4%), obesity (3.4%), lack of physical activity (3.2%), occupation (4.6%), hormone factors (3.2%), reproductive factors (3.1%) and radiation (0.9%), (Parkin, Boyd, & Walker, 2011). Adult weight gain in pre and postmenopausal women is consistently related to the development of postmenopausal BC

incidences (Harvie et al, 2005; Kawai et al, 2010). This is due to elevated levels of insulin- like growth factor (IGF), with higher insulin levels leading to increased secretion of oestrogen binding to the circulating sex- hormone- binding globulin (SHBG) which favours breast carcinogenesis (Khan, Shukla, Sinha, & Meeran, 2013).

Premenopausal women

The median age at menopause in Western countries is typically 51 years (Stanford, Hartge, Hoover, & Brookmeyer, 1987) therefore age classification for pre-menopause is below the age of fifty. BC risk could be affected by several reproductive hormonal factors and has been hypothesized that endrogens sex hormones influence risk (Adami et al, 1995). It can be complicated by variation in hormone concentrations across menstrual cycle of follicular phase affecting oestradiol, and oestrone, and luteal phase affecting progesterone, androstendione, DHEAS (dehydroepiandrosterone sulphate), testosterone and SHBG (Perez Garcia, 2013). There have only been seven studies to date produced (CLUE I, European Prospective Investigation into Cancer and Nutrition-EPIC, Nurses' Health Study- NHS-II, New York University Women's Health Study-NYU WHS, Hormones and Diet in the Etiology of Breast Tumors- ORDET) and a more recent one produced again by EPIC, because of smaller numbers of BC incidences compared to post-menopause and the need to account for a variation in serum oestrogens and progesterone during menstrual cycle is more complex and is less established (Yang et al, 2011; Cecchini et al, 2012).

In an analysis on seven prospective studies produced (on women who were diagnosed with BC before the age of fifty) in 2013 by Perez Garcia found BMI was

inversely associated with oestradiol, (luteal phase) progesterone and SHBG mean concentrations (17%, 28% and 46% respectively) in women with a BMI under 22.5kg/m^2. However free oestradiol, oestrone, DHEAS, testosterone and calculated free testosterone were positively associated with BMI with mean concentrations (10%, 16%, 8%, 7% and 63% higher respectively) in women with a BMI of 30.5kg/m^2 and above compared to women with a BMI below 22.5kg/m^2. Which strongly suggests increased BC risk in premenopausal women with higher concentrations of sex hormones. All hormones (total oestradiol, Free oestrodiol, Non- SHBG oestradiol, Oestrone, Oestrone sulphate, DHEAS and testosterone) except androstendione were associated with BMI. If free oestradiol is a reliable index of bioavailable oestradiol then obese premenopausal women are exposed to a slightly more oestrogenic environment (Perez Garcia, 2013). However these studies have large random error associated with assay variations and standardisation is needed also fluctuations in serum levels within individual women was seen and other studies argue these findings. Hung et al, 1997 found high BMI (>30kg/m^2) associated with lower BC incidences before menopause on female nurses aged between 30- 55 years (40% were premenopausal). This study was not produced on BC incidences compared to the analysis on seven prospective studies by Perez Garcia in 2013. BMI is only one indication of possible BC risk. This is debatable because BMI does not take into account body fat distribution and inconclusive as to whether body fat distribution in relation to visceral adiposity is more of a reliable indication (Khosla, & Lowe, 1967). This is because of the connection of multiple hormonal and metabolic changes such as insulin resistance and hyperinsulinemia, decrease in SHBG levels and androgen levels which in turn converts to oestrogen in adipose tissue, but found no

associated risk other than hip circumference (P= 0.03) in a study by Lahmann et al (2004). The latest study by Kaaks et al (2013) did show a positive association of overall risk with total and free testosterone between highest versus lowest quartiles (OR 1.56; 95% CI: 1.15, 2.13, P = 0.02 and OR 1.33; 95% CI: 0.99, 1.79, P = 0.04 respectively) and found no significant association for progesterone, SHBG, total and free oestradiol (Kaaks et al, 2013). Therefore due to a limited amount of studies produced to assess premenopausal women and risk of BC due to menstrual cycle and hormones is inconclusive. Further studies are needed with a standardised assay. Due to postmenopausal risk prevention of obesity (BMI< 30kg/m^2) before onset of menopause is advantageous because weight gain can be difficult to reverse (Rossner, Hammarstrand, Hemmingson, Neovius, & Johansson, 2008).

Postmenopausal women

Postmenopausal breast cancer accounts for two- thirds of cases amongst high risk (BMI >25kg/m^2) women, with a 16- 40% lifetime risk (Cecchini et al, 2012). The risk increases to 40% amongst those who are a carrier of the gene BRCA1 and 50% amongst BRCA2 carriers (Yang et al, 2011).

***Weight*:**

A pooled analysis of seven prospective studies by Van de Brandt et al (2000) show significant relative risk of breast cancer weighing 80kg (RR 1.25; 95% CI: 1.02, 1.52, P = 0.003) or more compared to those that weigh less than 60kg with a RR 1.06 per 10kg increment in weight (Van de Brant et al, 2000). The analysis used self reported data of height and weight which could give biased

information, and other prospective studies by Tretti in 1989 and Swanson, Jones, Schatzkin, Brinton and Ziegler in 1988, where weight was actually measured reported inconclusive associations between weight and BC risk.

Tretti (1989) defined body size by weight by using relative weight, or skinfold measurements (triceps and elbow); Swanson, Jones, Schatzkin, Brinton and Ziegler, (1988) found no association with weight and breast cancer risk comparing second versus fourth quartile (RR 0.8; 95% CI: 0.5, 1.4 and RR 1.0; 95% CI: 0.7, 1.9, P = 0.86 respectively). There was also no association when using skinfold thickness (triceps) (RR 1.5; 95% CI: 0.9, 2.7 and RR 1.4; 95% CI: 0.9, 2.8, P = 0.45 respectively), but found a significant association (P = 0.03) with BC incidences where height and elbow width was defined as body size in second quartile (RR 1.5; 95% CI: 0.9, 3.0) compared with forth quartile (RR 2.0; 95% CI: 1.3, 3.8) (Swanson, Jones, Schatkin, Brinton & Ziegler, 1988). However concerns regarding measurement error associated with skinfold determinations due to very obese women are subject to error (Khosla, & Lowe, 1967) and possible adiposity was under estimated, it is unlikely to be misclassified into lower quartile of skinfold thickness however measuring central adiposity would be a more reliable association due to risk associated with BC incidences. There needs to be validated anthropometric guidelines when assessing weight especially related to body fat defined for overweight and obese populations for reliability and consistency between studies is needed.

BMI:

Association with BMI and risk was also significantly positive (P = 0.001) for women with a BMI 29- <31kg/m^2 (RR 1.21; 95% CI: 1.01, 1.46), compared with women with a BMI of 21- <23kg/m^2 (RR 1.14; 95%CI: 1.01, 1.46) (Van de Brandt et al, 2000). Therefore women exceeding a BMI of 28.5kg/m^2 have a 54% increased risk of BC (Lahmann, Lissner, Gullberg, Olsson, & Berglund, 2003). Also a 31% increased (BMI >30kg/m2) risk among hormone replacement users compared to a BMI<25kg/m^2 (Lahman et al, 2004). However indices based on height and weight is very debatable because they do not take into account muscularity or bone structure. The two have unavoidable disadvantages and body fat distribution in relation to visceral adiposity is more of a reliable indication for risk of BC (Khosla, & Lowe, 1967).

Waist measurements:

Waist circumference (WC) was moderately associated with increased BC risk, (RR 1.05; 95% CI: 1.02, 1.09) for every 2inch (5cm) increase. The highest WC of 36.0- 55.0 inches (91.4- 139.7cm) compared to lowest measurements of 28.0-29.9 inches (72- 76cm) (RR 1.07; 95% CI: 0.84, 1.35 and RR 1.30; 95% CI: 1.02, 1.65 P = 0.01 respectively). After accounting for BMI the association was lower (RR 1.05; 95% CI: 0.82, 1.33, and RR 1.26; 95% CI: 0.88, 1.81, P = 0.15), and was no longer significant, and those taking hormone replacements had no association, but those who used them in the past the association with WC was borderline significant (P = 0.06). However there was no clear dose response relationship between WC and risk of BC (Huang et al, 1999). WC is often used as a surrogate marker of abdominal fat because it correlates with abdominal

subcutaneous and intra-abdominal fat (Pouliot et al, 1994). Women with a WC >80cm with BMI above 25kg/m^2 are at an increased risk of breast cancer (Klein et al, 2007; Wang, Rimm, Stampfer, Willett, & Hu, 2005) due to deposits on insulin resistance, lipoprotein metabolism and BP (Klein et al, 2007), especially associated with a BMI 30kg/m^2 and above with a WC > 88cm (Lean, Han, & Morrison, 1995). However there is no strong evidence demonstrating that WC reduction provides clinically meaningful information for lowering BC risk but reducing obesity- related risk factors for the disease is favourable (Kein et al, 2007).

The serum oestrogens (Oestrone and oestrone sulphate) are related to increased BC risk. High serum levels (>1.700.27 pmol/L) to lowest (<776.82 pmol/L) have an OR 2.3; 95% CI: 1.1- 4.6 and OR 2.3; 95% CI: 1.1, 4.7, P= 0.02 respectively (Adly et al, 2006).

It is clear that insulin levels in relation to postmenopausal women and breast cancer risk is linked. This is because insulin has complex interactions with oestrogens that increase adipose connective tissue cells by an enzyme that results in the production of oestrogen outside the ovaries. Insulin also induces tumour cell sex steriod hormone receptor expression and suppresses SHBG which may enhance oestrogen synthesis and bioactivity with consequent promotion of oestrogen dependent BC (Rose, & Vona- Davis, 2012). Therefore research suggests a diet that decreases oestrogen levels and reduces BMI (< 25kg/m^2) as well as having a WC less than 80cm is recommended.

Diet for prevention of breast cancer

Weight loss reduces body fat and lean mass (FFM) following energy restricted diet, however does macronutrient composition of the diet influence these changes? Fat mass reduction and maintaining lean mass seems to have no difference in changes to body composition or abdominal fat between macronutrient amounts in a study by Souza et al in 2012 in the pound lost trial (Souza Bray et al, 2012).

It is clear that obesity- related conditions could reduce BC risk because by reducing overall weight will improve insulin sensitivity. Dietary interventions that are effective are needed to promote long-term adherence. It is said that diets containing high protein (20- 25% energy) consistently report greater satiety, fat loss and preservation of fat- free mass (FFM) compared to low protein diets (15% energy) (Wycherley, Moran, Clifton, Noakes, & Brinkworth, 2012).

Mediterranean diet:

A Mediterranean diet significantly reduces endogenous oestrogen levels in healthy postmenopausal women by more than 40% (Carruba et al, 2009). This could be due to women who are high consumers of meat and starch and low consumers of vegetables and soy showed high risk in BC incidences (OR 2.19; 95% CI: 1,40, 3:42; P= 0.0005) and SHBG concentrations were 23% lower in women with high intakes of meat (RR per 23g per 1000kcals= 1.12; 95% CI: 1.02, 1.22, P= 0.014), starch (RR per 81g per 1000kcals = 1.10; 95% CI: 1.01, 1.21, P= 0.038) and low intakes of vegetables and soy patterns. Compared with low intakes of meat and starch and high intakes of vegetables (RR per 89g per 1000kcals = 0.90; 95% CI: 0.82, 0.99, P= 0.027) and legumes (RR per 30g per

1000kcals = 0.87; 95% CI: 0.79, 0.95, P= 0.0036) seen in a typical Mediterranean diet, therefore this suggests high intakes of legumes and low consumption of meat and starch is associated with a reduced risk of BC due to hormone concentrations (SHBG). This study was produced on Asian Americans and results may be different depending on ethnicity (Wu, Yu, Tseng, Stanczyk & Pike, 2009). Phytanic acid which is a branch chained fatty acid found mainly in red meat and dairy products is derived from phytol which converts into phytanic acid (Body, 1977). UK diets are suggested to be derived almost exclusively from ruminant animals (Allen et al, 2008). A study produced by Allen et al in 2008 looked at plasma phytanic acid concentrations in ninety six British women who were meat eaters, lacto- ovo- vegetarians and vegans found concentration levels of phytanic acid much higher (5.77umol/L) compared to vegans (0.86umol/L) and a 47% higher mean concentration than vegetarians (5.77umol/L compared to 3.93 umol/L, P= 0.016 respectively). The strongest plasma phytanic acid concentration appeared in dairy fat intake (r= 0.68, P< 0.0001) and phytanic acid level, was not associated with age or lifestyle factors (Allen et al, 2008). Therefore circulating phytanic acid levels are strongly associated with dietary intake of fat from dairy products and may contribute towards BC. Other findings found a weak positive association (P = 0.04) with substitution of saturated fats for carbohydrate consumption within eight prospective studies by Smith-Wamer et al, (2001). The diets were measured using a food and frequency questionnaire (FFQ) at baseline which can underestimate by as much as 20% especially within the obese population (Freedman, Schatzkin, Midthine, & Kipnis, 2011; Neuhouser et al, 2008). Boyd et al in 2003 found inconclusive results in a case- controlled cohort study on forty five published studies between 1966-

2003. Khodarahmi and Azadbakht in 2014 also rejected findings. These results being inconclusive on dietary fats with increased BC risk could be due to the complexity of measurement errors, high correlation between specific types of dietary fat, the confounding variables like body fatness and high energy intake and other dietary components such as fibre and antioxidants could be explanations for inconsistent results (Smith-Wamer et al, 2001).

Low- fat dairy however found an inverse associated risk with BC risk suggested in a Women's Health Initiative (WHI) study in a randomised control dietary modification trial, by Prentice et al (2006). Although the results did not show a statistical significant reduction in BC risk (HR 0.91; 95% CI: 0.83, 101) between groups it did show a non -significant trend which was observed and suggests a reduced risk in BC is associated with a low- fat dietary pattern. The groups were not evenly matched on numbers (intervention; n = 19,541, comparison; n = 29,294) to give a fair outcome but did indicate longer planned, non- intervention follow up may yield a more definitive comparison (Prentice et al, 2006).

Lipid composition in the Mediterranean diet may also have inhibitory potential on HER2 (ERB-2) expression (Menendez, Vazquez- Martin, Ropero, Colomer & Lupu, 2006). A minor compound squalene present in virgin olive oil in quantities as much as 13,000mg/kg has been suggested to lower BC risk (Allouche, Jimenez, Gaforio, Uceda, & Beltran, 2007). The average daily intake of squalene in Mediterranean countries is in the range of 200- 400mg per day in olive oil (George, Liu, Ahrens, Schreibman, & Crouse, 1976; Sotiroudis & Kyrtupoulos, 2008) due to protecting against oxidative DNA damage in MCF10A human mammary epithelial cells showed a significant decrease of up to 60% reduction in a dose dependant manner (50um) (Warleta et al, 2010). Also cooking with

olive oil, rich in monounsaturated fatty acids (Oleic acid) containing 72% of Oleic acid reduces the risk of BC compared to hydrogenated fats (OR 1.58; 95% CI 1.20- 2.10) or with vegetable or corn oil containing 30% in Linoleic acid (OR 1.30; 95% CI 1.06- 1.58) (Wong, John, Hom- Ross, & Ingles, 2008). However Oleic acid is debatable depending on countries and dietary consumption. The variations seen in a study by Simonsen et al in 1998 found an inverse association was strongly associated with Spain (Malaga) (OR, 0.40; 95% CI; 0.28, 0.58, P= 0.05). The mean concentration in the Spanish population was 55% compared to the Netherlands (Zeist) at 40% (OR: 2.36; 95% CI: 1.01, 5.50). The higher concentrations in the Spanish population may be due to other individual dietary consumptions of monounsaturated (MUFA) and total polyunsaturated fatty acids (PUFA). This study had large variations in numbers of participants within each group (Simonsen et al, 1998), which would give biased results but did have a standardised algorithm to identify unreliable assays, (Kardinael et al, 1993). Therefore a diet rich in olive oil and polyunsaturated fats is inconclusive but may be more favourable towards an inverse association with BC incidences.

Daily restricted Mediterranean diet (DRMD)

Overall Mediterranean diet may have thought to have eight components; fats (MUFA and PUFA), ethanol, legumes, carbohydrates (low GI), fruit and vegetables, meat and meat products and milk and dairy products (Trichopoulou et al, 1995).

Studies produced up to date on the Mediterranean diet can be seen by the EPIC study in 2010 by Trichopoulou, Bamia, Lagiou and Trichopoulos where they found incidences of BC following the plan was not statistically significantly

associated (Hazard ratio (HR) 0.88; 95% CI: 0.75, 103). However among post-menopausal women a slight inverse association of increased conformity to the Mediterranean diet with risk of BC (HR 0.78; 95% CI: 0.80, 1.28, P= 0.05). The reliability of FFQ is debatable on accuracy for self- assessment (Trichopoulou, Bamia, Lagiou & Trichopoulos, 2010). Based on this study it can be said 10% of BC cases in this population could be avoided if all women shifted their diet closely related to the Mediterranean dietary pattern.

Intermittent energy restriction (IER) compared to daily-energy restricted diets (DER)

DER is the most popular weight- control programme, however IER has been suggested as another alternative solution (Harvie et al, 2013) to improve insulin sensitivity, (Harvie et al, 2011) and lipid profiles (Hill et al, 1989) compared to DER.

A study that looked at participants with a family history of BC and the effect of intermittent energy (70% energy restriction) and carbohydrate (<40%) restricted (IECR) for two days a week and to consume euenergetic Mediterranean style diet. Compared to a daily 25% energy restriction (DER) seven days a week on weight loss and metabolic disease risk marker in over weight women by Harvie et al (2013). A further group of IECR which allowed unlimited protein and fats (IECR + PF) for a three month weight loss period. There was a small reduction in fat free mass (FFM) which was less in the IECR + PF group (20.4%) compared with both IECR (36%) and DER (29.3%) (Harvie et al, 2013). Results assessing weight, adiposity and circumference over the three month weight loss intervention comparing the three diets can be seen in table 1.

Table 1: Weight, adiposity and circumference over a three month trial.

(Mean values)

Parameters	IECR	IECR + PF	DER
Weight (KG)	74.4	77.6	82.3
BF (KG)	27.3	29.7	33.7
FFM (KG)	46.7	47.9	48.9
Waist (CM)	95.2	99.3	102.7
Hip (CM)	104.8	107.1	109.8
Bust (CM)	99.4	101.4	106.2

*BF= Body fat, FFM= fat free mass, KG= kilograms

*IECR= Intermittent energy carbohydrate restriction, PF= ad libitum protein and fat, DER= daily energy restriction.

In both IECR groups experienced significantly greater and comparable reductions in body fat than the DER group (IECR, P= 0.007 and IECR + PF, P= 0.019) but no significant greater reduction in weight, waist, hip and bust circumference. This randomised trial indicates that a short term (12 week) weight loss intervention on IECR is superior to the DER diet in respect to body fat reduction however weight loss is just as effective across all three groups (Harvie et al, 2013). This positive result of the present study requires further studies to test accuracy of the present short term results that experienced a high drop out rate (23%) which was reported. This study is however comparable with many weight loss studies and showed a positive result similar to a study by Dansinger, Gleason, Griffiths, Selker and Schaefer (2005). They compared Atkins (carbohydrate restriction), Ornish (fat restriction), Weight Watchers (calorie

restriction) and Zone (macronutrient balance) diets and found a modest reduction in body weight (53%, 50%, 65%, 65%, respectively) after one year (Dansigner, Gleason, Griffiths, Selker, & Schaefer, 2005). This suggests a diet following energy restriction independent of macronutrient composition is effective for weight loss (Souza Bray et al, 2012).

Low fat compared to low carbohydrates

The effects of low carbohydrates (<45% of energy) compared to low- fat diet (<30% energy) on metabolic risk factors were compared in randomised meta-analysis. Out of twenty three trials compared by Hu et al in 2012 with a total of 2,788 participants (1,392 on low carbohydrate and 1,396 on low fat diets) over a 6- 24 month period and sixteen studies were over twelve month intervention. The dietary nutritional composition was varied across the studies ranging from 4- 45% carbohydrate consumption with a mean intake of 23%. In the low carbohydrate group and low fat intake ranged from 10- 30%, with a mean range of 26%. However the mean energy intake was self- reported at approximately 2,000 kcals per day with approximately 40% of participants were male.
The mean outcomes of change can be seen in table 2.

Table 2: mean outcomes of change on low carbohydrate and low fat diet

Measurements	Low carbohydrate	Low fat
Body weight (KG)	6.1	5.0
Waist (CM)	6.2	6.0
Total cholesterol (mg/dL)	4.6	10.0
LDL cholesterol (mg/dL)	2.1	6.0
HDL Cholestrol (mg/dL)	4.5	1.6
Triglycerider (mg/dL)	30.4	17.1
Systolic BP (mmHg)	3.5	3.0
Fasting blood glucose (mg/dL)	10.4	10.1

* KG- Kilograms, CM- Centimetre, mg/dL- Milligram/ decilitire, mmHg- Millimetre of mercury, BP- blood pressure

The difference in body weight at 95% confidence intervals was -1.0kg and waist circumference -0.2cm, therefore reductions were not statistically significant. However there was substantial evidence indicating that low carbohydrate diets are just as effective for weight loss, with body weight and waist circumference reductions, with a mean reductions ranging from 1.5kg to 14.3kg and from 2.2 to 9.3cm respectively regardless of age, gender, length of intervention, diabetes status and level of carbohydrate restriction (Hu et al, 2012). The link to consuming a diet rich in carbohydrates may promote hyperinsulinemia and insulin resistance (Sieri et al, 2007). This is in fact due to high GI diets that are associated with greater insulin secretion (Kaaks, & Lukanova, 2002). Insulin plasma appears to directly regulate IGF affecting IGF-I availability, therefore

obesity with a diet rich in rapidly digestible carbohydrates and poor fibre intake, increases the development of insulin resistance and hyperinsulinemia (Kaaks, 2001). IGF-I regulates cellular proliferation and apoptosis and has been associated to BC with a stronger association in women aged fifty (RR 2.5; 95% CI: 1.4, 4.3) (Schemhammer, Holly, Pollak & Hakinson, 2005).

The Genesis Prevention Centre in a study by Harvie et al in 2011 found similar results to the Harvie et al 2013 study where restricting carbohydrates for two days a week may be a better dietary approach than standard calorie- restricted diets. Two diets were compared for effects on weight loss and blood markers of BC risk. The patients were randomly assigned onto either, a very low calorie restricted diet (VLCD) for two days per week (75%) and no restriction the other five days, compared to a continuous energy restriction (CER) (25% restriction) seven days a week (30% fats, 15% monounsaturated fats, 7% saturated fats, 7% polyunsaturated fats, 45% low GI carbohydrates and 25% protein). The results concluded that both groups experienced modest declines (P = 0.04) in fasting serum insulin and improvements in insulin sensitivity (-1.2 uU/mmol/L) and insulin resistance (-1.2 uU.mmol/L) (Harvie et al, 2011). This is the largest randomised study comparing isocalorific intermittent versus continuous energy restriction. Only two small other randomised studies have been produced to date over a twelve week programme. Ash et al (2003) compared IER as a very low calorie diet (VLCD) using a liquid meal replacement for four days a week (<800kcal/d) and then three days consuming normal foods ad libitum compared to CER diet on patients with type 2 diabetes. Both groups showed no difference in terms of weight loss or fasting insulin (Ash et al, 2003) which argues the study by Harvie et al in 2013 where intermittent VLCD did have greater long- term

weight loses in FM than low calorie diets (LCD), however this study was using liquid milk meal replacement compared to normal food consumption (Tsai & Wadden, 2006). Patients with type 2 diabetes showed beneficial effects of a periodic VLCD on either one day a week or five consecutive days every five weeks in addition to a normal daily restriction (6180 to 7416 KJ/ day) and found greater effects on long term glycaemic control independent of weight loss (Hill et al, 1989).

The studies so far on diets to reduce obesity for prevention of BC shows intermittent approach appears to be just as effective as DER (Harvie et al, 2011; Harvie et al 2013) especially when carbohydrates are less than 45% (Hu et al, 2012) and protein increased to more than 20% on two days of the week. Also due to the reduction of oestrogen levels following a Mediterranean style diet (Carruba et al, 2009) five days a week to give an intermittent approach seems more favourable.

1.5: Group weight loss support

Self- monitoring is the prime importance of behaviour towards a weight loss intervention programme which involves typically a decrease in energy intake and increase in energy expenditure as well as behavioural strategies such as goal setting and self monitoring (Burke, Wang, & Sevick, 2011). Also combining support whether in a group setting or on a one to one basis for the effectiveness of obesity management .The current findings suggesting a twelve week group based dedicated programme of weight management can result in clinically useful amounts of weight loss (5%- 10%) that are sustained at one year, (Jolly et al, 2011).

The Look AHEAD study by Thomas et al (2014) is the longest randomised controlled trial (RCT). The lifestyle intervention was effective over eight years in both men and women combined with weight loss weekly group support sessions (1-3 weeks). Then every forth week met individually with their interventionist for approximately 20- 30 minutes and found 50% of patients with type two diabetes lost more than 5% of their body weight. This suggests weekly group support and educational talks along with one to one sessions every month is essential for successful weight loss interventions (Thomas et al, 2014). This supports the Lighten up randomised trial study by Jolly et al (2011), which examined six weight loss programmes, three commercial groups (Weight watchers, Slimming World and Rosemary Conley), and three run by primary care (Size, Down, General Practice and pharmacy), see table 3 (Jolly et al, 2011).

Table 3: Proportion of weight loss that achieved 5% loss in body weight at the end of 12 weeks.

Weight loss programme	Percentage (95% CI)	Relative risk* (95% CI)
Weight Watchers	46	2.98 (1.56 to 5.66)
Slimming World	35	1.56 (0.81 to 3.01)
Rosemary Conley	42	2.72 (1.42 to 5.23)
Size Down	18	0.63 (0.30 to 1.33)
General Practice	15.7	0.62 (0.27 to 1.41)
Pharmacy	21.4	0.87 (0.39 to1.94)

* Adjusted for physical activity at baseline, weight at baseline, age, sex, and ethnic group

The three support groups demonstrates that a group setting combined with one to one support is more effective than just one to one support seen in the Primary Care groups to achieve at least 5% weight loss within a twelve week programme.

Conclusion

The risk of breast cancer can be reduced by as much as 10% in females by reducing weight and total body fat to a healthy range. To focus on a diet typical to that of the Mediterranean as it significantly reduces endogenous oestrogen levels in healthy postmenopausal women by as much as 40% who are at high risk.

Carbohydrates have widely differing plasma glucose concentrations and insulin responses and a diet high in low- GI foods, which in turn increases dietary fibre and lowers serum glucose levels is beneficial in keeping plasma glucose concentrations and insulin responses low.

Dietary fats are inconclusive and more studies on low- fat dairy consumption and improved dietary intake as well as accurate measurements on dietary assessments other than a FFQ at baseline would be an advantage.

Studies up to date on the Mediterranean diet, low carbohydrate, low fat, IECR, IER and DER all have comparable results in weight loss apart from Harvie et al study in 2013 which compared intermittent carbohydrate and energy restriction found a significant difference (P= 0.007) in body fat % within the IECR group compared to DER. This is just one study and further studies are needed to compare results similar to low carbohydrate intermittent diet to a daily Mediterranean calorie controlled diet, where energy restriction (<25%) is consistent over the seven days within both groups on a healthy female

overweight population which is missing so far. The need to assess if intermittent low carbohydrate diet will yield greater weight loss than daily restricted Mediterranean diet and if intermittent low carbohydrate diet will give greater reduction in body fat composition compared to a daily restricted Mediterranean diet. Combining a structured optional weekly group support sessions may be an advantage to participants who struggle to follow a plan alone. The Look AHEAD study by Thomas et al (2014) is the longest (eight years) RCT intervention in both men and women combining weekly group support for weight loss (Thomas et al, 2014). This study supports the rationale to adherence to intervention trials.

Studies so far comparing IECR diets have been produced as RCT on breast cancer patients, a family history of breast cancer, or on diabetes patients. Therefore further studies involving healthy female population is lacking so far.

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Research project:

Weight loss intervention trial comparing intermittent low carbohydrate versus continuous Mediterranean diet

Word count: 3, 781

Weight loss intervention trial comparing intermittent low carbohydrate versus continuous Mediterranean diet

Keywords: Obesity: Body composition: Breast cancer; Daily energy restriction

Journal appropriate to publication

This research paper is appropriate for the publication of the British Journal of Human Nutrition and Dietetics, which meets submission guidelines relating to research articles in clinical nutrition and for practising dieticians. Specifically within obesity, nutrition and nutritional epidemiology to increase knowledge in nutritional science and the use of intervention studies to test their effectiveness. This study is the original work by the author that has never been published previously.

Abstract

Intermittent low carbohydrate diet (ILCD) may result in greater overall weight loss and body fat % than a daily restricted Mediterranean diet (DRMD). Overweight women (BMI 25kg/m^2 - <32.4kg/m^2) (*n* 85) aged 25- 65 years on healthy women not on any medication were randomised to a continuous 25% daily energy restriction in both groups, to either a DRMD (7d/ week) or ILCD (<20% carbohydrates for 2d/ week consecutively then follow a DRMD 5d/week) for a twelve week weight- loss period. Body fat % reduced with the DRMD (median -2.9kg (95% CI: -2.6, -2.1) and the ILCD diet (median -2.9kg (95% CI: -2.3, -2.0). Reductions were not significantly different between the two diets. Reductions in weight loss in the DRMD (median -1.7kg (95% CI: -1.6, -0.1) and ILCD (median -1.0kg (95% CI: -1.5, -1.0) between groups also showed no statistical difference. Waist reduction in the DRMD (mean -5.7cm (95% CI: -5.8, -

5.5) and in the ILCD (mean -5.6cm (95% CI: -3.6, -5.8) with greater reductions in the DRMD compared to the ILCD group was significant (mean -0.1cm (95% CI: -2.2, -0.3, P= 0.04). Hip reduction in the DRMD (median -4.3cm (95% CI: -4.6, -4.2) and in the ILCD (median -3.7cm (95% CI: -4.6, -1.2) with greater reductions in the DRMD compared to ILCD group was also significant (median -0.6cm (95 CI: -0.0, -3.0, P= 0.02).

Both diets overall are just as effective and there is no evidence that ILCD is superior for fat loss than a DRMD. In the short term DRMD is comparable to ILCD with respect to waist (P = 0.04) and hip circumference (P = 0.02). Drop out rate was low (11%) compared to previous studies (22%- 25%). Long- term studies into the effectiveness and adherence to the ILCD diet are warranted and rejects both hypotheses.

Introduction

The health issues affecting the UK associated to obesity- related breast cancer (BC) incidences and other metabolic diseases such as diabetes, cardiovascular disease (CVD) and other certain cancers may be reduced by weight loss and greater improvements in body composition results. Reduction in waist circumference (WC) and fat mass (FM) could be associated with improving insulin sensitivity (Lahmann, Hoffmann, Allen, Van Gils, Khaw, & Riboli, 2004). Therefore lowering insulin levels may lead to a decreased secretion of oestrogen binding to SHBG which favours breast carcinogenesis and could reduce BC incidences (Khan, Shukla, Sinha, & Meeran, 2013). Also consuming a diet rich in carbohydrates may promote hyperinsulinemia and insulin resistance (Seri et al, 2008). This could be achieved by effective dietary interventions to promote adherence to long- term results and the need to preserve lean body mass

(Lovemann, Frampton, Shephard, Picot, Cooper, Bryant & Clegg, 2011). Such interventions need to be able to reach satiety with nutritional requirements to promote loss of fat and preservation of fat- free mass (FFM) safely and effectively (Wycherley, Moran, Clifton, Noakes, & Brinkworth, 2012). Most weight control programmes use daily energy restriction (DER) however intermittent energy restriction (IER) has been suggested as an alternative approach (Harvie et al, 2011). This is possibly because IER may be easier to follow and potentially have positive metabolic effects (Harvie et al, 2013).

There have been various dietary approaches using different intermittent energy restriction requirements and macronutrient compositions (Harvie et al, 2013; Harvie et al, 2011; Trichopoulou, Bama, Lagiou, & Trichopoulos, 2010; Ash et al, 2003; Hu et al, 2012). The effect of intermittent restriction has so far been produced using energy restriction or energy and carbohydrate restriction two days a week on populations with health related conditions. It is unclear as to whether just intermittent carbohydrate restriction (2d/ week consecutively) following a DER over seven days a week will give the same overall results.

Here the report on effectiveness with respect to change in body composition (FM) as the primary outcome to assess if intermittent low carbohydrate diet will give greater reductions in body fat % compared to a daily restricted Mediterranean diet. The secondary outcomes of weight, waist and hip circumferences are also analysed to examine if intermittent low carbohydrate diet will yield greater weight loss than a daily restricted Mediterranean diet. The carbohydrate restricted (<20% carbohydrates) for 2 consecutive days a week. Restricted days were low in carbohydrates and relatively high in protein and fats (20% carbohydrates, 45% protein, 35% fats) to maximise satiety and to limit the

loss of FFM within energy restriction. A calorie restriction (25%) was given over the seven days. This was compared against a DRMD with relatively high protein, moderate fats and carbohydrate intake (45- 50% carbohydrates, 20- 25% protein and 30% fat) over a twelve week programme (Wyerley, Moran, Clifton, Noaks, & Brinksworth, 2012). This appears to be the first study seen using intermittent low carbohydrates, where the energy intake of 25% remained continuous across the full seven days, in both groups.

Methods

Subjects

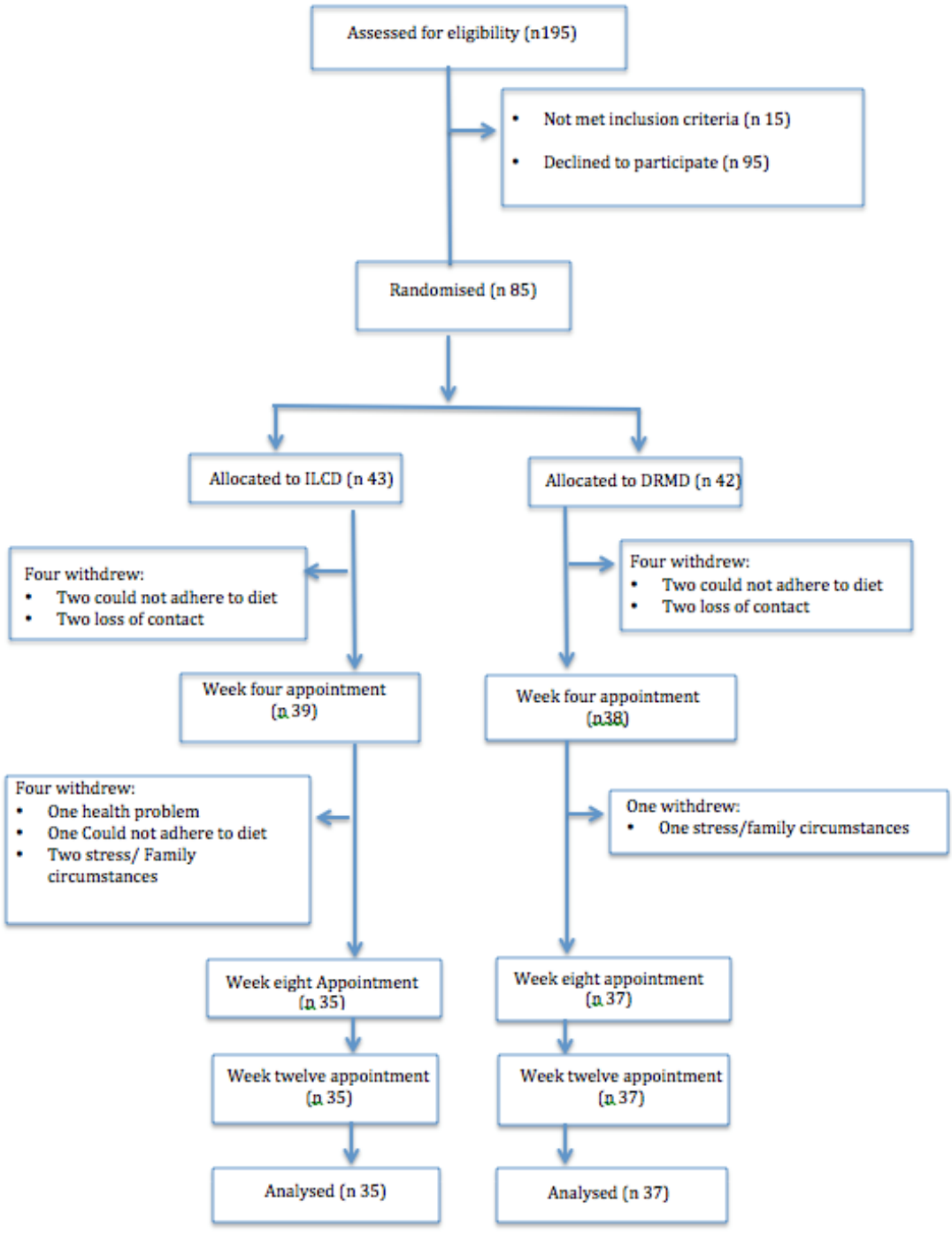
This present randomised trial included 85 healthy women from Worcestershire aged 25 to 65 years of age. Women were eligible for the study if their BMI was between 25- 32kg/m^2, aged between 18- 65 years, on no medication, not breast feeding or pregnant within the last 12 months. Women were excluded if they were currently dieting, or suffering from cancer, diabetes, cardiovascular disease, epilepsy, or any musculoskeletal conditions. Participants were enrolled between March 2015 and May 2015. Ten participants were recruited each week over nine weeks. Recruitment came from a range of sources, email database previously enrolled with a dieting club but no longer dieting or of whom reached their goal weight (over 2,000 women), social media (Facebook and Twitter), free press release in local paper, 100 posters in and around the area, and two interviews with a local radio station. Participants were not dieting before commencing the twelve week weight loss intervention trial. Interested participants were screened to assess if they met the criteria (see appendix 1). All

procedures were approved by the Faculty of Life Sciences Research Ethic Committee, (FREC) (reference 992/15/ST/CSN) (Appendix 2).

Study protocol

Participants were stratified according to age and BMI. A total of 85 participants were recruited. Women were randomly assigned to either an intermittent low carbohydrate calorie controlled diet, (ILCD) (20% carbohydrates, 45% protein, and 35% fats) two days a week then following a daily- restricted Mediterranean diet (DRMD) (45- 50% carbohydrates, 20- 25% protein, and 30% fats) five days a week, with a total of 43 women in the group. The second group was required to follow DRMD seven days a week, with a total of 42 women assigned to this diet plan. See fig 1 for screening process.

Fig 1. CONSORT (Consort Standards of Reporting Trials) screening, recruitment and withdrawal information. ILCD, intermittent low carbohydrate diet, DRMD, daily restricted Mediterranean diet.



(CONSORT standard of reporting trials; Schulz, Altman, & Moher, 2010)

Measurements were made at baseline and at week 4, 8 and 12. These included primary measurements, total body fat (FM), fat free mass (FFM) determined by impedance (Tanita body composition analyser SC-330ST) and secondary measurements; waist (narrowest part of torso level of the "natural" waist between ribs and iliac crest), and hip (maximum posterior extension of buttocks) circumference, weight, systolic and diastolic blood pressure (Omron M6) was taken at each data collection. BP was taken to assess if participants were well to continue with the trial, height taken only at baseline (Seca 213) to assess for accuracy of BMI for recruitment criteria (Heywood, & Wagner, 2004), and to allocate a calorie allowance using the Henry equation (Henry, 2005).

All assessments were carried out in the morning or afternoon with follow up appointments taken within two hours of baseline time. Weight was assessed wearing light clothing. Body circumferences were measured in triplicate according to study protocols for inter-observer reliability testing to ensure reliability (WHO, 2015) and before trial commenced fifty random females (not on trial) were practised for accuracy to comply with a 10% margin for error (Callaway et al, 1988). BP was measured in triplicate after at least 5 minutes at rest and the mean value calculated. If three readings were recorded as hypertension (>135/ 85mmHg) a signed GP consent form was required to continue the trial (Appendix 4). Subjects were asked to abstain from vigorous activity and alcohol for 12 hours prior to assessment for adequate hydration using BIA and not to consume caffeine, smoking or eating thirty minutes before taking BP measurements (Appendix 3).

Adherence to the dietary intervention; participants were contacted by text or email after the first week of beginning the trial to assess if extra support was

needed. They were also advised to take part in ninety minutes of moderate exercise per week (power walking 3-4 mph, gentle jogging, swimming, cycling) this could be split into 9 x 10 minutes or 2 x 45 minute sessions. They could also attend two structured group sessions per week instead to keep participants motivated. Seven sessions were available from Monday- Saturday in the morning or an evening which included; a weekly weigh in (optional), group talk (five- ten minutes) on motivation, nutrition or exercise, followed by a 45 minute aerobic workout all ran by the interventionist at community halls and schools local to their area (Appendix 5). Protocols of risk assessments were recorded at each session (Appendix 6).

Appointments for week 4, 8 and 12 were made four weeks in advance with a forty -eight hour text or email message reminder to allow participant to re-schedule and to remind them of their next one to one meeting for data collection. If participants needed to re-schedule an alternative appointment was given within two days (before/ after) within same time frame.

Dietary interventions

Both diets involved a 25% energy restriction from estimated baseline energy requirements. The calculations used were based on their age, height and weight (Henry, 2005) to calculate basal metabolic rate (BMR). To predict a daily calorie energy intake a physical activity level (PAL) (DoH, 1991) was calculated (BMR x PAL) and then a daily 25% calorie deficit was prescribed to both groups (Appendix 7).

Diets were provided to participants in an A5 spiral bound format with a list of macronutrients and calorie breakdowns per 100g, and also broken down to per

serving (or item), using "Nutritics" professional nutrition Analysis software programme (Appendix 8, 9). Participants were also advised to use a free app (myfitnesspal) downloaded to their phone, Ipad or computer to track their macronutrient composition and calorie intake.

To maximise compliance participants had the option to receive one to one support twice a week, at the group sessions or by email, text or phone calls whenever they felt they needed contact. The initial first week all subjects were contacted to confirm they understood the diet plans to be able to continue with the trial. They were also encouraged to self -monitor energy intake either by diet diary or phone app.

Statistical analysis

Inferential tests on baseline and week 12 are presented. The primary aim of the study was to determine changes in body composition (FM) between DRMD and ILCD and secondary outcomes on weight, waist and hip circumference over a twelve week intervention period. Power calculations to define the probability of rejecting the null hypotheses which suggested an 80% power (assuming a standard deviation of 1:1 unit) to detect differences of 0.8 or more (Surresh, & Chandrashekara, 2012) allowing for a 25% drop out. Data at baseline and week twelve are presented and tested for normal distribution using Shaprio Wilk because there were under 100 participants. Ratio data was present as a means (95% CI) using an independent t-test for parametric data or medians (95% CI) for non- parametric variables using a Mann Whitney U that violated normal distribution. The primary analysis was an intention-to-treat (ITT) analysis that includes all subjects in a last observation carried forward (LOCF) at baseline and

week 12, between groups. Defined as randomisation adjusted for baseline level of each parameter to assess if there were any statistical significance (P<0.05 was accepted) between two groups. Data was analysed using SPSS (version 22; SPSS limited, 2013).

Results

Study population

Baseline and clinical characteristics of the two groups of randomised women are reported in table 1. The groups were of comparable age, BMI and height. The only co- morbidity selected to take part on the trial was hypertension (no medication) with a signed GP consent form, which was detected at baseline. A total of 11 participants (26%) with hypertension were randomly selected onto the DRMD and 8 (19%) onto the ILCD. All the subjects were 100% Caucasian. In total 13 women withdrew from the study (11%): DER *n* 5 (2.1%), ILCD *n* 8 (3.4%). The reason for the dropout were family/ stress related issues (DER *n* 1, ILCD *n* 2), Problems adhering to the diet (DER *n* 2, ILCD *n* 3), loss of contact (DER *n* 2, ILCD *n* 2), and unrelated health issues (ILCD *n* 1) (fig 1).

Table 1: Baseline characteristics of the subjects.
(Mean values and standard deviations; and minimum and maximum ranges)

	ILCD (n 43)	**DRMD (n 42)**
Age at start (years)[1]	46.4 (10.0)	44.6 (10.5)
Minimum	29	25
Maximum	63	65
Baseline BMI (kg/m²)[1]	29.2 (2.1)	28.2 (2.4)
Minimum	25.0	24.9
Maximum	32.4	32.4
Height (cm)[1]	164.1 (5.5)	164.1 (5.5)
Minimum	153.5	152.5
Maximum	178.0	182.5
Ethnic origin		
Caucasian	43 (100%)	42 (100%)
Co morbidities		
Hypertension	8 (19%)	11 (26%)

* ILCD- Intermittent low carbohydrate diet; DRMD- Daily restricted Mediterranean diet
[1]Mean (SD) Independent sample T test

Changes in body composition- primary outcome

FM had positive results but showed no significant difference between groups (Appendix10). The average FM reduction over the twelve weeks in the DRMD was -2.9kg (95% CI: -2.6, -2.0) compared to the ILCD group -2.9kg (95% CI: -2.3, -2.1) (fig 2). FFM also had no statistical difference (Appendix 11) however a slight overall difference in the DRMD group lost slightly higher amounts (-1.7kg (95% CI: -2.9, -0.1)) compared to ILCD -1.2kg (95% CI: -2.3, -1.0). When comparing week one to week eight FFM shows a significant difference (P= 0.05) between the DRMD group (-0.9kg; 95% CI: -0.9, -1.0, P= 0.04) compared to ILCD (0.0kg; 95% CI: -0.2, -0.9) (Fig 3) however when comparing more than two

variables a Bonferroni adjustment is needed to prevent at type I error (Tabachnick, 2013). This creates a new Alpha level (0.05/3= 0.017) of 0.02 therefore this result became non significant.

Fig 2: Change in body fat (FM)

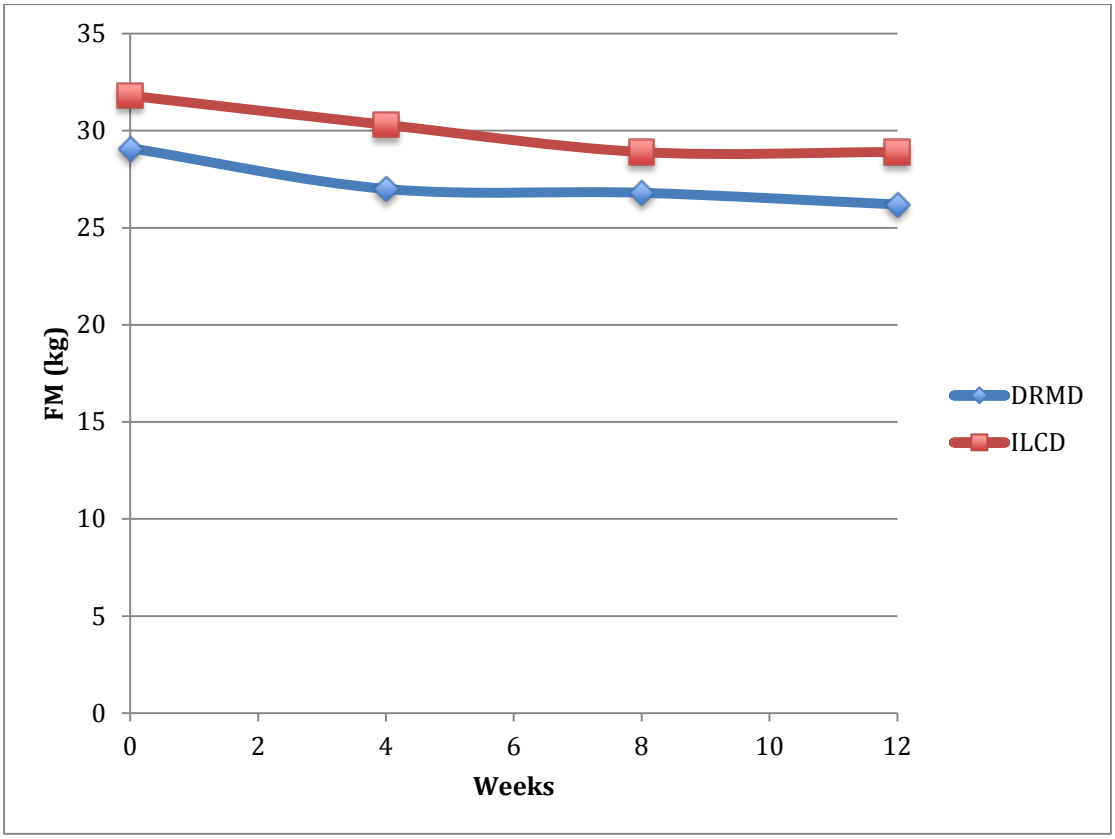
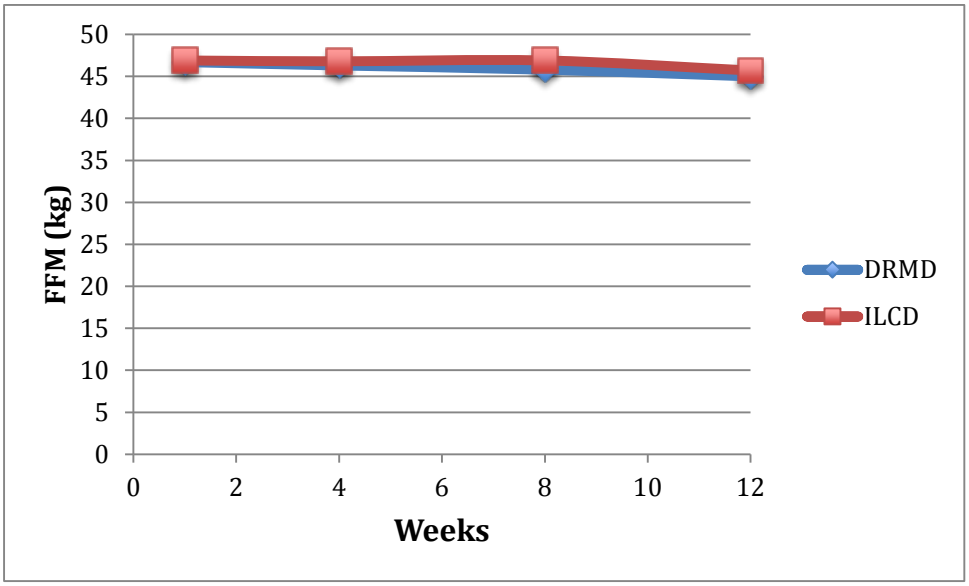


Fig 3: Change in fat free mass (FFM)



Changes in weight, and circumferences- secondary outcome

The proportion of the two groups achieving 5% or greater weight loss over twelve weeks was 36%, with 36% and 37% following the DRMD and ILCD respectively. However weight loss was not significant between the two groups (Appendix 12). DRMD experienced significant difference in reductions to waist (P = 0.04) compared to the ILCD group (Appendix 13). The mean waist measurement reduction over the twelve week programme was -5.7cm (95% CI: -5.8, -5.5) in the DRMD group compared to -5.6cm (95% CI: -5.5, -5.8) in the ILCD group, and hip circumference showed significant differences (P= 0.02) with -4.3cm (95% CI: -4.6, -4.2) in the DRMD compared to -3.7cm (95% CI: -4.6, -1.2) reduction in the ILCD group (Appendix 14). Systolic BP also reducing by an average of 6.0mm/Hg compared to 7.4mm/Hg in the DRMD and ILCD respectively but showed no significant difference (table 2).

Table 2: Body composition, fat mass and fat free mass over twelve weeks
(Mean values and 95% confidence intervals)

Parameters*	Baseline		Week twelve		
	Mean	95% CI	Mean	95% CI	P Values
FM (KG)**					0.063**
Median					
ILCD	31.8	30.4, 33.4	28.9	28.1, 31.4	
DRMD	29.1	28.0, 31.9	26.2	25.4, 29.8	
FFM (KG)**					0.463**
Median					
ILCD	46.9	46.1, 47.8	45.7	44.6, 46.8	
DRMD	46.7	45.4, 47.5	45.0	43.8, 47.6	
Weight (KG)					0.068
ILCD	79.5	77.4, 81.6	77.0	74.9, 79.1	
DRMD	76.6	74.0, 79.2	73.8	71.0, 76.6	
Waist (CM)					0.043
ILCD	95.0	93.0, 97.0	88.7	87.4, 91.3	
DRMD	92.0	89.8, 94.2	86.3	84.0, 88.7	
Hip (CM)**					0.023**
Median					
ILCD	101.9	108.6, 112.0	105.8	104.0, 110.8	
DRMD	106.2	105.9, 109.6	101.9	101.3, 105.4	
Systolic BP (mmHg)					0.463
ILCD	125.0	121.3, 128.9	117.7	113.3, 122.1	
DRMD	124.9	120.8, 129.0	118.9	114.6, 123.2	
Diastolic BP (mmHg)**					0.673**
Median					
ICD	80.0	78.0, 82.9	78.0	76.4, 82.0	
DRMD	80.0	78.2, 83.5	78.4	75.6, 81.2	

*ILCD (*n* 43), DRMD (*n* 42)
**Mann Whitney U for LOCF between the two groups at twelve weeks adjusted for baseline values

Discussion

The present randomised trial indicates that in the short term (12 weeks) both diets are just as effective for primary (FM) and secondary (weight) outcomes for overall weight loss and the DRMD is comparable to the ILCD in both waist and hip circumferences. The results also concur with other related published studies (Harvie et al 2011; Hu et al, 2012; Ash et al, 2003; Hill et al, 1989), however there was a slight difference in a study by Harvie et al in 2013 where FM did show a significant difference (P = 0.007) within the intermittent energy and carbohydrate restriction (IECR) compared to the DER group.

The two groups (DRMD and ILCD) in this current study included a 25% continuous energy restriction over the seven days and the ILCD had a reduction in carbohydrate restriction (<20% carbohydrates 2d/ week consecutively followed by 45- 50% carbohydrates 5d/ week) compared with DRMD (45- 50% carbohydrates over 7d/ week).

Limitations

Body fat (FM and FFM) was assessed using bioelectrical impedance. This method is prone to error where there are fluctuations in body water content especially as this study did not time biomarker assessment in relation to the menstrual cycle which may give higher readings due to water retention (Dehnghan, & Merchant, 2008). Due to the standardised conditions used, impedance has been shown to be a valid method for assessing change within weight loss studies. This is in comparison with appropriate reference method of assessing body fat % such as the gold standard dual- energy X-ray absorptiometry (McArdle, F. I. Katch, & V. L. Katch, 2010).

An ITT analysis based of LOCF was presented. A LOCF analysis was the most appropriate method and preferable technique. Drop out from weight loss studies are well known to be linked to poorer success. An LOCF allows all participants to be contributed to the data and accounts for potential bias (Gupta, 2011).
BMI was stratified at baseline only so results potentially could not be skewed, by an indirect measurement of body fat, since baseline BMI did not predict success or drop out (Rothman, 2008).
Dietary intake was self reported and could possibly be underreporting energy consumption by as much as 20%. This does depend on participant characteristics also long term studies are more susceptible to this error (Horner, Patterson, Newhouser, Lampe, Beresford, & Prentice, 2002; Martin, Jones, Lockwood, Tritchier, & Boyd, 1996).
Power calculations were adequately powered to avoid a type II error (Peipert, Metheny, & Schulz, 1995).

Comparison with other studies.

There has been limited research on IER. There have been no studies produced so far on intermittent low carbohydrates (ILCD) without combining intermittent very low energy restriction two days per week. Two small randomised studies over a twelve week intervention have been reported on the effects of IER and CER. Hill et al (1989) found no significant difference in body fat (6.1 ± 0.6kg and 6.0 ± 0.8kg respectively). Also no significant difference was found in WHR, within 40 obese women, with a total drop out rate of 20% (Hill et al, 1989). Ash et al (2003) compared IER (4180KJ liquid VLCD 4 days/ week, 3 days ad libitum) compared to CER (6000 to 7000 KJ/day) amongst 51 men with type 2 diabetes

and showed no difference in overall body fat, waist and weight measurements between the two groups (Ash et el, 2003).

Two larger studies one produced by Harvie et al (2011) compared CER (25% calorie restriction) with VLCD (2060 to 22266KJ of energy per day for 2 days a week). Results also found no difference in reductions in body fat, FFM, weight and hip measurements between groups. The overall weight loss was 30% in the IER group and 33% in the CER achieving >5% weight loss on 107 overweight and obese women, with a family history of breast cancer. The low drop out rate was good compared to other studies at 17%. Also another study by Harvie et al (2013) found similar results on 115 women with a family history of breast cancer on weight, waist and hip circumferences. However a significant difference ($P = 0.007$) was shown in body fat in both IECR groups combining IER and low carbohydrate (<20%) 2d/ week, than the DER (IECR, $P = 0.007$ and IECR + PF, $P = 0.019$) which is the first study shown so far to see a comparable difference, with a higher drop out rate of 23%.

In this study, which is the first looking at a healthy population of 85 women, with a very low drop out rate in comparison (11%) to the research reported so far on intermittent diets. The results found both diets (DRMD and ILCD) were equally effective. Participants achieving >5% weight loss over the twelve weeks was also equivalent at 37% (36% DRMD and 37% ILCD). This is a common criterion of clinically meaningful weight loss (National Institute of Health, 1998).

The only difference seen in all five studies on intermittent diets is Harvie et al (2013) achieving a significant difference in body fat %. This may be because of the combined intermittent very low energy and carbohydrate restriction.

Harvie et al in 2011 researched just energy restriction and this current study on only carbohydrate restriction and both of these had the same effective results with no significant differences between the groups. This supports findings by Seiman et al (2015) on a systematic review on forty publications of clinical trials were analysed and found intermittent fasting produces similar effects to a continuous energy restriction to reduce body weight, fat mass, fat- free mass and improve glucose homeostasis (Seiman et al, 2015).

Strengths of this study

This randomised trial allows the effects of ILCD to be directly compared with those of standard DRMD approach and shows comparable benefits. Good retention to the study achieving at least 5% weight loss (37% at 12 weeks) and completeness of trial assessments means the LOCF analysis informs the relative acceptability and efficacy of the two diets. The two groups provided a 25% energy restriction with one group (ILCD) that also required a simple low carbohydrate intake (<20% 2d/week consecutively). This approach on intermittent restriction appears to be the only study achieved so far amongst overweight healthy female population where previous studies reported have been on populations with metabolic diseases already being diagnosed at baseline. This study also appears to be more achievable to adhere to than previous studied regimens where IER and ILCD were combined with a higher drop out rate (25%). Where this is considered to have very low drop out rate (11%) when compared to a large observational cohort study where drop out ranged between 18- 26% dependent on calorie restriction (LCD 23%, VLCD 18%

and restricted normal food 26%) (Hemmingsson, Johanssan, Riksson, Sundstum, & Marcus, 2012).

Conclusion and future studies

Intermittent low carbohydrate diet appears to be just as effective for weight loss as the DRMD in a female population and rejects both hypotheses. The positive results of this present study warrant further studies to see if replicated combined with a very low calorie deficit 2d/ week (<75%) would give overall significant difference in body fat similar to Harvie et al (2013). Also more long - term studies and comparing results on a male population are needed. No single dietary approach is appropriate and feasible for all given the complexity of weight management and further alternative dietary interventions for weight-loss programmes are warranted.

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Appendices

A1- Screening questionnaire

Screening- Questionnaire

Weight loss and body composition intervention trial

Researcher*: Sandra Todd*

Name:_____ Date:_____

Contact number:_____ Date of birth:_____

Email address_____

In order to ensure that this study is as safe and accurate as possible, it is important that each potential participant is screened for any factors that may influence the study. Please circle your answer to the following questions:

1. Have you ever been diagnosed with any of the following:

Heart Disease YES/NO

High blood pressure YES/NO

Diabetes YES/NO

Cancer YES/NO

Asthma YES/NO

Epilepsy YES/NO

Fainting YES/NO

Dizziness YES/NO

2. Has your doctor ever said that you have a heart condition *and* that you should only perform physical activity recommended by a doctor? YES/NO

3. Do you feel pain in the chest when you perform physical activity? YES/NO

4. In the past month, have you had chest pain when you were not performing physical activity? YES/NO

5. Do you lose your balance because of dizziness *or* do you ever lose consciousness? YES/NO

6. Do you have bone or joint problems (e.g. back, knee or hip) that could be made worse by a change in your physical activity? YES/NO

7. Is your doctor currently prescribing drugs for your blood pressure or heart condition? YES/NO

8. Are you pregnant, or have you been pregnant in the last twelve months? YES/NO

9. Are you, or have you been breast-feeding in the last twelve months? YES/NO

10. Have you injured your hip, knee or ankle joint in the last six months? YES/NO

11. Are you taking any medication? YES/NO

12. Do you know of any other reason why you should not participate in physical activity? YES/NO

13. Do you know of any other reason why you should not participate in a weight loss programme? YES/NO

Thank you for taking your time to fill in this form. If you have answered 'yes' to any of the above questions, unfortunately you will not be able to participate in this study.

A2- FREC approval letter

Faculty of Life Sciences
Research Ethics Committee

frec@chester.ac.uk

Sandra Todd
60 Evergreen Way
Stourport on Severn
Worcestershire
DY13 9GH

13 February 2015

Dear Sandra

Study title: **Weight loss intervention trial comparing intermittent low carbohydrate versus continuous Mediterranean diet**
FREC reference: **992/15/ST/CSN**
Version number: **1**

Thank you for sending your application to the Faculty of Life Sciences Research Ethics Committee for review.

I am pleased to confirm ethical approval for the above research, provided that you comply with the conditions set out in the attached document, and adhere to the processes described in your application form and supporting documentation. However, the Committee would like to request the following amendments:-

The final list of documents reviewed and approved by the Committee is as follows:

Document	Version	Date
FREC Application Form	1	Jan 2015
List of References	1	Jan 2015
C.V. for Lead Researcher	1	Jan 2015
Letter of invitation to participants	1	Jan 2015

Participant Information Sheet	2	Jan 2015
Consent form	1	Jan 2015
Permissions to use premises	1	Jan 2015
Interview schedule	1	Jan 2015
Advertising material	2	Jan 2015
Risk assessment	1	Jan 2015
Measurement protocols	1	Jan 2015
Exercise plan	1	Jan 2015
Details of intermittent diet	2	Jan 2015
Details of Mediterranean diet	2	Jan 2015
Lone worker procedure	1	Jan 2015
GP referral letter	1	Jan 2015
Risk assessment feedback	1	Jan 2015
Data collection sheets	1	Jan 2015
Flow chart	1	Jan 2015
Food and physical activity diary	2	Jan 2015
Details – 45 mins aerobic session	1	Jan 2015
Exclusion letter	1	Jan 2015
Equation for calories allowance	2	Jan 2015
Screening questionnaire	2	Jan 2015
Exclusion criteria	1	Jan 2015
Incident procedure	1	Jan 2015
Data collection time slots	1	Jan 2015
Response to FREC	1	Feb 2015

Please note that this approval is given in accordance with the requirements of English law only. For research taking place wholly or partly within other jurisdictions (including Wales, Scotland and Northern Ireland), you should seek further advice from the Committee Chair / Secretary or the Research and Knowledge Transfer Office and may need additional approval from the appropriate agencies in the country (or countries) in which the research will take place.

With the Committee's best wishes for the success of this project.

Yours sincerely,

Dr. Stephen Fallows
Chair, Faculty Research Ethics Committee

Enclosures: Standard conditions of approval.

Cc. Supervisor/FREC Representative

A2- FREC amendment BMI approval letter

Faculty of Life Sciences
Research Ethics Committee

frec@chester.ac.uk

Sandra Todd
60 Evergreen Way
Stourport on Severn
Worcestershire
DY13 9GH

25/02/2015

Dear Sandra

Study title:	**Weight loss intervention trial comparing intermittent low carbohydrate versus continuous Mediterranean diet**
FREC reference:	**992/15/ST/CSN**
Version number:	**1**

Thank you for providing notice of variation to the above project.

The following variation has been approved by the Faculty Research Ethics Committee:-

- Increase of permitted participant BMI to 32kg/m^2

With the Committee's best wishes for the success of this project.

Yours sincerely,

Dr. Stephen Fallows
Chair, Faculty Research Ethics Committee

A3- Protocols for all measurements

Hip and waist measurements

- A minimum of three measurements of each site taken in rotational order
- Tension to tape measure will be applied so it fits snugly around the body part and does not indent the skin or compress the subcutaneous tissue
- The tape measure should be applied in a horizontal plane, parallel to the floor
- The tape measure will be made of flexible material
- Technician skill is not a major source of error
- Measurements will be taken in a private room
- Participants will be asked to wear similar light clothing for each data collection to limit any errors
- Practising on at least 50 people for each site in a rotational order will be performed before the trial begins
- Need to consider menstrual cycle because fluid retention may affect accuracy of circumference measurements
- Measurements will be recorded in cm's at baseline, week 4, week 8 and week 12
- See table 1.2 for position, anatomical reference and measurement technique

Table 1.2 Standardized sites for circumference measurements

Site	Anatomical reference	Position	Measurement
Hip (buttocks)	Maximum posterior extension of buttocks	Horizontal	Apply tape snugly around buttocks.
Waist	Narrowest part of torso, level of the "natural" waist between ribs and iliac crest	Horizontal	Apply tape snugly around the abdomen at level of greatest anterior protuberance. Take measurement at end of normal expiration

Data from Calloway et al. (1988)

Height measurements

- The stadiometer- Seca model number 213
- The participant stands barefoot on the flat surface which will be right angle to the vertical rod of the stadiometer
- Weight evenly distributed between the two feet
- Arms hang down by the side with palms facing the thighs
- Heels together touching the vertical board at 60 degree angle to each other
- The head, scapula and buttocks should be touching the vertical board
- The head erect with eyes focused straight ahead
- The participant will inhale deeply while the horizontal board lowered on the stadiometer to the most superior point on the head, compressing the hair
- Standing height is measured to the nearest 0.1cm
- Measurements will be recorded at baseline, week 4, week 8 and week 12

Weight measurements

- Participant stands on the platform of the scales with body weight evenly distributed between the feet
- Light indoor clothing is recommended
- No shoes
- Measurement will not be recorded immediately after exercise
- The participant will be weighed at each time point, baseline, week 4, week 8 and week 12 at the same time of day
- The same or similar clothing must be worn at each time point to avoid error
- Urination before taking measurement will be required
- Measurements will be recorded in Kg
- Scales to be used are: Tanita- SC- 330ST

Body Composition

- Participant stands on the platform with body weight evenly distributed parallel to the electrodes with shoes and socks/ stockings off
- Standing without bending knees
- Body type is selected (Standard or athletic) all participants in this study will be selected standard
- Gender (female) will then be selected
- Age and height is then inputted into the body composition analyser
- The participant needs to stand as still as possible ensuring arms are not touching their sides and inner thighs are not touching each other during measurements
- Measurement is then complete
- Things that will need to be performed are: measurements will be avoided immediately after exercise, soles of feet clean and dry and free from excess dirt
- Excessive food and fluid consumed at least an two to three hours before readings
- Measurements of body composition will be recorded at baseline, week 4, week 8 and week 12
- The same or similar light clothing worn at each time point
- Measurements will be recorded at a similar if not the same time on each data collection
- If possible to urinate before taking measurement
- 0.9kg will be allowed for light clothing
- Prohibition of alcohol, excessive exercise for 12 hours before measurement because of dehydration
- Bio- electrical impedance analyser is used using a one point of contact (feet)
- Make and model of equipment- Tanita Body composition analyser SC-330ST
- Weight (kg) fat mass (FM) and weight (kg) fat free mass (FFM) will be recorded
- This measurement will be recorded twice beginning and end of each data collection session for accuracy

Blood pressure

- Make and model- Omron Healthcare M6 comfort upper Arm blood pressure monitor
- Fully automatically clinically validated monitor with dual- sized cuff for comfortable, quick and accurate blood pressure monitoring
- Hypertension indicated displays a symbol on the screen if the unit takes a reading that is higher than the recommended level of 135/ 85 mmHg
- If high blood pressure is recorded participant will be given a letter to send to their GP to get checked out. A letter of consent needs to be signed by the GP to allow participant to continue with the trial, otherwise will be excluded
- Cuff wrapping indicates if the cuff has been wrapped correctly to ensure accurate reading
- Dual check system provides a second check to ensure the measurement's accuracy
- To apply cuff remove tight fitted clothing or roll sleeves up out of the way
- Participant needs to be sat down in a chair, upright with back straight and both feet flat on the floor.
- Put the arm through the cuff loop
- Position correctly- The bottom edge of the cuff should be 1cm to 2cm above elbow
- Need to make sure the tube to blood pressure monitor is centred on the middle of the participants inner arm
- Close fabric firmly
- Need to be careful not to allow participant to rest arm on the tube
- The cuff should be placed on the same arm at each time point (baseline, week 4, week 8 and week 12)
- The participant must be relaxed and comfortable before measurements begin
- No drinking alcohol, caffeine, smoking exercising or eating 30 minutes before taking measurement
- The cuff should be at the same level as the participants heart
- Three readings recorded at each measurement to ensure correct accuracy and an average recording will be taken

A4- GP letter

Researcher: Sandra Todd
60 Evergreen Way
Stourport on Severn
Worcestershire
DY13 9GH

Date:_____

Dear Sir/ Madam,

I am currently studying my final research project towards an MSc in “Exercise and Nutrition science” at the University of Chester. While conducting baseline measurements for a Weight- loss intervention trial, on your client _____, I detected high blood pressure with a reading of _____mmHg.

I have referred _____ to you for further investigation. I need your consent for your client to continue with the trial.
Could please sign this letter below if you feel confident for her to continue.

I appreciate your co-operation in this matter

Yours Faithfully

Sandra Todd

Please can you fill the form in and circle your answer.

After assessing _____

I can confirm she can **continue/ not continue** with the weight intervention trial.

Name of GP/ Nurse_____

Surgery_____

Signature_____

Thank you for your co-operation.

Please send back using the self addressed envelope provided.

A5- Structured exercise timetable

Timetable of aerobic session including venue addresses held throughout the week for participants to take part in

	Monday	Tuesday	Wednesday	Thursday	Saturday
Morning session	**10.00am- 11.30am** Areley Kings Village Hall, Areley Common, Stourport, Worcestershire, DY13 0BA		**9.30am- 11.00am** Wolverley Memorial Hall, Shatterford Lane, Wolverley, Kidderminster, Worcestershire, DY11 5TN	**10.00am- 11.30am** Stourport Workman's Club, Lickhill Road, Stourport, Worcestershire, DY13 8SB	**9.00am- 10.00am** Franche Primary School, Chestnut Grove, Kidderminster, Worcestershire, DY11 5QB
Evening session	**6.00pm- 7.30pm** Blakedown Primary School, Birmingham Road, Blakedown, Worcestershire, DY10 3JN	**6.00pm- 7.30pm** Stourport Primary School, Park Avenue, Stourport, DY13 8SH	**6.00pm- 7.30pm** St Catherine's Primary School, Marlpool Lane, Kidderminster, Worcestershire, DY11 5HL		

** Please note the first 45 minutes will be a one to one chat followed by a talk to the group which will be motivational, nutrition or exercise related

A6- Risk assessment sheet

Date															**Action required**
Name and address of venue:															
Fire Exits Accessible/Unlocked															
First Aid Kit Accessible															
Emergency Phone Accessible															
Room – Adequate temp/Ventilation															
Floor – dry, clear from obstruction, in good order															
Any displays, equipment or storage around the edge of room is secure															
Lighting – adequate and even															
Toilets unlocked (with toilet rolls)															
Equipment checked- Toning bands															
Signed															

A6- Risk assessment report form to venue

Risk assessment feedback report

Venue used_____Date of use_____

For the attention of_____

From_____

While completing my health and safety risk assessment checklist the following hazard/ potential risk was identified:

Please make your own assessment of my concerns and provide feedback below:

Action taken:

By whom_____Date completed_____

Please return this report to me in its entirety using the enclosed stamped addressed envelope. Thank you.

A7- Calorie breakdown

Working out calorie allowance based on gender, age, height (cm) and body mass (kg)

All participants will be female so the equation used to work out individual BMR is based on Henry (2005) equation, (Henry, 2005)

Aged 18- 30 years of age *(SE 0.564)*

BMR=Basal metabolic rate in kcal/day

Formula:
BMR = (10.4 x body mass, kg) + (615 x stature, metres)– 282= Kcals

Example

Data: Body mass= 64.41kg and stature= 1.70m

BMR= (10.4 x 64.41) + (615x 1.70) – 282=

BMR= 669.76 + 1,045.50 -282= 1,433.26 Kcals

BMR= 1, 433.26 Kcal per day rounded to 1,433 Kcal per day

Aged between 30- 60 years (SE 0.564)

BMR=Basal metabolic rate in kcal/day

Formula:
BMR = (8.18 x body mass, kg) + (502 x stature, metres)– 282=

Example

Data: Body mass= 64.41kg and stature= 1.70m

BMR= (8.18 x 64.41) + (502x 1.70) – 282=

BMR= 526.79 + 853.40 -282= 1,098.19 Kcals

BMR= 1, 098.19Kcal per day rounded to 1,098 Kcal per day

Aged 60+ (SE 0.472)

BMR=Basal metabolic rate in kcal/day

Formula:
BMR = (8.52 x body mass, kg) + (421 x stature, metres) + 10.7 =

Example

Data: Body mass= 64.41kg and stature= 1.70m

BMR= (8.52 x 64.41) + (421x 1.70) + 10.7=

BMR= 548.69 + 715.70 +10.7= 1,275.09 Kcals

BMR= 1, 275.09 Kcal per day rounded to 1,275 Kcal per day

To predict a daily calorie allowance for participants using their current physical activity level (PAL) by splitting into categories are as follows; occupation, non-occupation and time in bed will be recorded using DoH, (1991) PAL levels.

Example:

	Hours	**PAL level**
Bed	8	1.0
Occupation	7	2.2
Non- occupation	9	1.5
Total hours	**24**	

(PAL)_____ X (BMR)_____ = _____Energy requirement

25% Kcal reduction

_____/ 100 x 75 = _____Kcals per day

Break down of macronutrients based on a daily calorie allowance of 1,267 Kcal per day for Mediterranean diet plan.

45% carbohydrates- 570 Kcals

25% Protein- 317Kcals

30% fat- 380Kcals

Total- 1,267 Kcals per day

Breakdown of macronutrients based on a daily calorie allowance of 1,267 Kcal per day for the two day low-carbohydrate diet plan

20% carbohydrates- 253 Kcals

45% protein- 570 Kcals

35% fat- 444Kcals

Total- 1,267 kcals per day

A8- Intermittent low carbohydrate diet (ILCD)

Two day restricted low-Carbohydrate diet plan

20% carbohydrates, 45% protein, 35% fat

- Two days a week you are allowed foods that are high in protein, healthy fats, low- dairy foods, some vegetables and fruit
- For two days carbohydrates are limited to around 50g per day
- The two restricted days should be consecutive (back to back) to get the full benefits of the diet
- No strict calorie allowance as such as long as you do not exceed your personal daily allowance given to you on your first meeting
- 5 days a week following the Mediterranean diet plan
- Breakdown of calories for carbohydrates, protein and fats for the two days can be seen in the chart below.
- Weight loss progress chart can be tracked weekly or every four weeks to check your progress, see figure 1
- You will notice there are no carbohydrate lists this is because on the two days you need to avoid high carbohydrate foods due to the 20% restriction (50g per day)
- There are a few extra restrictions for vegetarians which are listed under vegetarian two day diet
- Myfitnesspal App downloaded to your phone, Ipad or computer will track your calories and percentages of fats, carbohydrates and protein to ensure you stay within the recommended amounts

Calorie progress chart- 5:2 plan

Date:	Kg	Stone and pounds
Start weight		

1st Stone weight loss goal	Calories (Kcal)
Calories given	
Carbohydrates	
Protein	
Fat	

Fig 1: Weight loss progress chart

1 stone												
13 ½												
13												
12 ½												
12												
11 ½												
11												
10 ½												
10												
9 ½												
9												
8 ½												
8												
7 ½												
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6 ½												
6												
5 ½												
5												
4 ½												
4												
3 ½												
3												
2 ½												
2												
1 ½												
1												
½												
Weeks	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**

Plot your weight loss weekly or every four weeks after your appointment with your interventionist.

Protein

Protein foods

Include:

- White or oily fish and seafood
- Chicken, turkey or duck (cooked without skin)
- Lean cuts of meat- for example beef, pork, lamb or offal, lean game, venison, rabbit or pheasant (Keep to a minimum of once a week)
- Pulses, beans, chickpeas and lentils- use these for bulking up dishes
- Low- fat processed meats, bacon, ham and salty fish such as kippers, smoked salmon, smoked mackerel and smoked white fish
- Eggs- Unlimited amounts

Limit to once a week

- Fatty cuts of red meat, poultry and game (these are high in saturated fats)
- High- processed meat products (for example sausage and corned beef- these are high in saturated fat and salt)
- Battered / breaded fish (these are higher in calories and much lower in protein than uncoated fish).
- Low- fat processed meats, bacon, ham and salty fish such as kippers, smoked salmon, smoked mackerel and smoked white fish to limit your overall salt intake

Table 1 gives you a break down on calories per 100g and per serving to help you stay within your limit.

Table 1: Protein calories per 100g and per serving/item

ITEM	Calories (Kcal) per 100g/ml weight	Per serving/ item
	PROTEIN	
FISH		
Cod -steamed	83	Medium fillet (120g)- 100kcals
Cod- steamed	83	Large fillet (175g)- 145kcals
Crab boiled	128	
Haddock grilled- raw	104	Small (50g)- 52kcals
Haddock grilled- raw	104	Medium (120g)- 125kcals
Haddock poached- raw	113	
Haddock smoked- poached raw	134	
Haddock smoked- steamed raw	101	Average 150g- 152kcals
Haddock steamed	89	Average 150g- 134kcals
Hake grilled- raw	113	1 average steak 100g- 113kcals
Halibut grilled- raw	121	1 Average 145g- 175kcals
Herring grilled	181	Small fillet (85g)- 154kcals
Herring grilled	181	Medium fillet (119g)- 215kcals
Kipper baked	205	Small fillet (85g)- 174kcals
Kippers- baked	205	Medium fillet (130g)- 267kcals
Kippers- baked	205	Large fillet (170g)- 349kcals
Kippers grilled with bones	161	
Lemon sole grilled- raw	97	Small (120g)- 116kcals
Lemon sole grilled- raw	97	Medium (170g)- 165kcals
Lemon sole grilled- raw	97	Large (220g)- 213kcals
Lemon sole steamed	91	Small (120g)- 109kcals
Lemon sole- steamed	91	Medium (170g)- 155kcals
Lemon sole- steamed	91	Large (220g)- 200kcals
Mackerel canned in brine	237	Small can (180g)- 427kcals
Mackerel canned in brine	237	Large can (390g)- 924kcals
Mackerel grilled with bones- skin	220	Average portion (160g)- 352kcals
Mackerel in tomato sauce	206	Average can (125g)- 258kcals
Mackerel- grilled	239	1 small fillet (50g)- 120kcasl
Mackerel grilled	239	1 medium fillet (80g)- 191kcals
Mackerel- smoked	354	1 small fillet (100g)- 354kcals
Mackerel- smoked	354	1 medium fillet (150g)- 531kcals
Monkfish grilled- raw	96	Average portion (70g)- 67kcals
Mussels boiled	104	1 mussel (7g)- 7kcals

Plaice grilled- raw	96	Small fillet (75g)- 72kcals
Plaice grilled- raw	96	Medium fillet (130g)- 125kcals
Plaice grilled- raw	96	Large fillet (173g) 173kcals
Prawns- boiled	99	1 shrimp (3g)- 3kcals
Prawns- boiled	99	1 king-tiger prawn (8g)- 8kcals
Salmon steak grilled -raw	215	1 average dame (100g) 215kcals
Salmon steak grilled- raw	215	1 large dame (190g)- 409kcals
Salmon steak grilled- raw	215	1 average cutlet/ steak (210g)- 452kcals
Salmon steamed- raw	194	1 average dame (100g) 194kcals
Salmon steamed- raw	194	1 large dame (190g)- 369kcals
Salmon steamed- raw	194	1 average cutlet/steak (210g)- 407kcals
Salmon steamed with bones-skin	150	1 average dame (100g) 150kcals
Salmon steamed with bones-skin	150	1 large dame (190g)- 285kcals
Salmon steamed with bones-skin	150	1 average cutlet/steak (210g)- 315kcals
Salmon- Baked	204	1 average dame (100g)- 204kcals
Salmon- baked	204	1 large dame (190g)- 388kcals
Salmon- baked	204	1 average cutlet/steak (210g)- 428kcals
Salmon- red canned in brine	153	Small can (105g)- 161kcals
Salmon- red canned in brine	153	Medium can (201g)- 321kcals
Salmon- Smoked	142	
Sardines canned in brine	172	1 sardine (25g)- 43kcals
Sardines grilled- whole	195	1 sardine (15g)- 29kcals
Sardines grilled- whole	195	Average portion (80g)- 156kcals
Sardines in spring water	182	1 sardine (25g)- 46kcals
Sardines in spring water	182	Average portion (85g)- 155kcals
Sardines in tomato sauce	162	1 sardine (25g)- 41kcals
Scallops steamed	118	
Sea bass or bream	124	
Swordfish grilled- raw	139	Average portion (140g)- 195kcals
Trout grilled	135	Average portion 60g- 81 kcals
Trout smoked	135	Average portion (60g)- 81 kcals
Tuna in brine	99	Small -100g (drained 72g)- 99kcals
Tuna in brine	99	Standard can 180g (drained 130g)- 129kcals
CHICKEN		
Chicken breast fillet	148	Pieces (45g)- 67kcals
Chicken breast fillet	148	Small fillet (90g)- 133kcals

Chicken breast fillet	148	Medium fillet (120g)- 178kcals
Chicken dark meat roasted	196	
Chicken drumsticks- no skin	152	1 small (35g)- 53kcals
Chicken drumstick- no skin	152	1 medium (45g)- 68kcals
Chicken drumstick- no skin	152	1 large (60g)- 91kcals
Chicken light meat- roasted	153	1 breast slice (40g)- 61 kcals
Chicken light meat- roasted	153	Small portion (70g)- 107kcals
PORK		
Bacon medallions	130	33kcals per 25g medallion
Bacon rashers grilled	307	20g- 61kcals
Bacon- streaky	337	20g, 1 slice -67kcals
Gammon joint boiled	204	1 med slice 130g- 265kcals
Gammon Steak grilled	209	
Pork loin chops	241	1 small (70g)- 169kcals
Pork loin chops	241	1 medium (136g)- 328kcals
Pork loin joint- roasted	253	1 thin slice (60g)- 152kcals
Pork loin joint- roasted	253	1 medium slice (130g)- 329kcals
Pork mince raw	164	
BEEF		
Beef braising steak- lean	246	1 average 50z (103g)- 253kcals
Beef brisket- boiled	268	1 average piece (290g)- 777kcals
Beef fillet steak- grilled med-rare	200	50z (103g)- 182kcals
Beef fillet steak- grilled med/rare	200	8oz (172g)- 344kcals
Beef mince- extra lean raw	174	
Beef- sirloin steak- grilled med/rare	176	5oz (103g)- 181kcals
Beef sirloin steak- grilled med/rare	176	8oz (172g)- 302kcals
Beef stewing steak- lean	203	
Beef topside- roasted med/rare	175	Thin slice (28g)- 50kcals
Beef topside- roasted med/rare	175	Thick slice (45g)- 79kcals
Rump lean- grilled	177	5oz (103g)- 182kcals
Rump lean- grilled	177	8oz (166g) 294kcals
OTHER MEATS		
Rabbit- stewed	114	½ rabbit (225g)- 257kcals
Venison- roasted	165	Average portion (120g)- 198kcals
Pheasant – roasted	220	1 Pheasant (430g)- 946kcals

Pigeon- roasted	187	1 Pigeon (115g)- 215kcals
Partridge- roasted	212	1 partridge (260g)- 551kcals
OFFAL		
Chicken Liver- raw	92	1 liver (44g)- 40kcals
Lambs Liver- raw	137	1 portion (85g)- 116kcals
Lambs liver-raw	137	1 liver (322g)- 441kcals
Ox Liver- raw	155	1 slice (50g)- 78kcals
Oxtail- stewed	243	
Pigs Liver raw	113	
VEGETARIAN		
Edamame beans boiled	122	½ cup (80g)- 97kcals
Hummus	297	1 teaspoon (10g)- 30kcals
Hummus	297	1 tablespoon (30g)- 89kcals
Hummus- reduced fat	187	1 teaspoon (10g)- 19kcals
Hummus- reduced fat	187	1 tablespoon (30g)- 56kcals
Quorn mince	105	1 serving (75g)- 79 kcals
Quorn mince	105	1 cup (100g)- 105kcals
Soya beans dried- boiled	141	1 tablespoon (10.7g)- 15kcals
Soya beans dried- boiled	141	1 cup (175g)- 247kcals
Tofu raw	76	¼ block 116g- 88kcals
Tofu raw	76	½ cup (125g)- 95kcals
Tofu raw	76	1 cup (250g)- 190kcals
Eggs boiled or poached	147	1 egg 50g- 74kcals
Eggs boiled or poached	147	1 large egg (57g)- 84 kcals
Eggs boiled or poached	147	1 jumbo egg (65g)- 96kcals

Fats

Table 1.1 Fats and calories per 100g and per serving/ item

ITEM	Calories (Kcal) per 100g/ml weight	Per serving/ item
	FATS	
LOW FAT SPREADS		
Margarine- flora light/ pro active	347	5g, 1 teaspoon- 17kcals
Margarine- low fat	350	9g, 1 teaspoon- 32kcals
OILS		
Olive oil	899	1 teaspoon (4.2g)- 38kcals
Rapeseed oil	899	1 teaspoon (4.2g)- 38kcals
NUTS		
Almonds with skin	596	6 almonds (6g) 36kcals
Brazil nuts	683	3 brazil nuts (15g) 102kcals
Cashew nuts	573	10 cashews (18g) 103 kcals
Peanuts	564	10 peanuts (13g) 73kcals
Pistachios	601	10 pistachios (7g) 42kcals
Walnuts	688	3 walnuts (12g) 83kcals
OTHERS		
Avocado	134	½ Avocado (120g) 161kcals
Mayonnaise	691	1 teaspoon (7g) 48kcals
Mayonnaise	691	1 heaped teaspoon (15g) 104kcals
Mayonnaise	691	1 tablespoon (22g) 152kcals
Mayonnaise	691	1 heaped tablespoon (33g) 228kcals
Mayonnaise- Reduced fat	288	1 teaspoon (7g) 20kcals
Mayonnaise- reduced fat	288	1 heaped teaspoon (15g) 43kcals
Mayonnaise- reduced fat	288	1 tablespoon (22g) 63kcals
Mayonnaise- reduced fat	288	1 heaped tablespoon (33g) 95kcals
Olives in brine	103	1 olive (2g) 2 kcals
Olives in brine	103	10 olives (20g) 21kcals
Peanut butter- reduced fat	548	1 teaspoon (14g) 77kcals
Peanut butter- smooth	607	1 teaspoon (14g) 85kcals
Peanut butter- wholegrain	606	1 teaspoon (15g) 91 kcals
Pesto- Green	412	1 teaspoon (8g) 33kcals
Pesto- Green	412	1 tablespoon (26g) 107kcals
Guacamole	128	1 tablespoon (35g) 45kcals

Dairy foods

Table 1.2 Dairy and calories per 100g and per serving/item

ITEM	Calories (Kcal) per 100g/ml weight	Per serving/ item
	DAIRY	
MILK		
Skimmed	32	200ml- 64kcals
Skimmed	32	400ml- 128kcals
Semi- skimmed	46	200ml- 92kcals
Semi-skimmed	46	400ml- 184kcals
Soya- sweetened	43	200ml- 86kcals
Soya- sweetened	43	400ml- 172kcals
Soya- unsweetened	26	200ml- 52kcals
Soya- unsweetened	26	400ml- 104kcals
Whole milk	66	200ml- 132kcals
Whole milk	66	400ml- 264kcals
CHEESE		
Camembert	290	
Cheddar	416	22g slice- 92kcals
Cheddar	416	¼ cup grated cheese(30g)- 125kcals
Cheddar ½ fat	273	Average slice (22g) 60kcals
Cheddar ½ fat	273	¼ cup grated cheese (30g)- 82kcals
Cottage cheese	101	1 Tablespoon (40g) 40kcals
Cottage cheese- reduced fat	79	1 tablespoon (40g)- 32kcals
Cottage cheese- reduced fat	79	1 cup (230g)- 182kcals
Cream cheese- low/medium fat	199	Teaspoon (17g) 34kcals
Cream cheese- low/medium fat	199	1 teaspoon (17g)- 34kcals
Cream cheese- low/ medium fat	199	1 tablespoon (51g) 101kcals
Cream cheese- extra light	111	1 teaspoon (17g)- 19kcals
Cream cheese- Extra light	11	1 tablespoon (51g)- 57kcals
Edam	341	
Feta	250	5x 1cm cube (30g) 75kcals
Halloumi	310	½ cup (70g) 217kcals
Mozzarella	257	Small ball (40g) 103kcals
Mozzarella	257	Average ball (125g) 321kcals
Mozzarella 10%	178	Small ball (40g) 71kcals
Mozzarella 10%	178	Average ball (125g) 223kcals

Parmesan	415	1 teaspoon (5g) 21kcals
Parmesan	415	1 tablespoon (15g) 62kcals
Ricotta- reduced fat	144	Teaspoon (10g) 14kcals
Ricotta- reduced fat	144	Tablespoon (30g) 43kcals
YOGHURTS		
Greek plain	133	125g 166kcals
Whole milk fruit	109	125g- 136kcals
Greek fruit- low fat	87	125g- 109kcals
Greek fruit- whole	137	125g- 171kcals
Quark	74	1 tablespoon (45g)- 33kcals
Low-fat fruit	78	125g- 98kcals
Whole milk fruit	109	125g- 136kcals
Greek 0% plain	57	125g- 71kcals
Virtually fat- free	47	125g- 59kcals

Fruit and vegetables

- Recommendations are to consume 7 portions per day- 1 fruit and 6 vegetables see table 1.3 for serving amounts. Treat fruit and vegetables as your carbohydrate calories.

Fruit

You can include one piece of fruit from the list below. If you prefer you can have an extra serving of vegetables instead of fruit.

Table 1.3: Fruit and calories per 100g and per serving/ item

ITEM	Calories (Kcal) per 100g/ml weight	Per serving/ item
	FRUIT	
Apples	47	
Apricots – fresh	31	1 average (40g)- 12kcals
Apricots- dried	188	1 piece (8g)- 15kcals
Apricots- dried	188	4 pieces (32g)- 60kcals
Apricots- fresh	31	4 apricots (160g)- 48kcals
Bananas	95	Small (60g)- 57kcals
Bananas	95	Medium (100g)- 95kcals
Bananas	95	Large (120g)- 114kcals
Blackberries	25	1 blackberry (5g)- 1kcal
Blackberries	25	6 blackberries (30g)- 8kcals

Blackberries	25	12 blackberries (60g)- 15kcals
Blackcurrants	28	5 blackcurrants (2g)- 1kcal
Blackcurrants	28	50 blackcurrants (20g)- 6kcals
Blackcurrants	28	80g- 22kcals
Blueberries	30	15 blueberries (30g)- 9kcals
Cherries	48	1 cherry (4g)- 2kcals
Cherries	48	10 cherries (40g)- 19kcals
Clementine peeled	37	Small (40g)- 15kcals
Clementine peeled	37	Medium (60g)- 22kcals
Clementine peeled	37	Large (80g)- 30kcals
Cranberries	15	10 average (20g)- 3kcals
Dates- dried	270	1 date (7.1g)- 19kcals
Dried mixed fruit	268	
Figs- dried	227	1 average (20g)- 45kcals
Figs- fresh	43	1 average (55g)- 24kcals
Grapefruit	30	½ average (100g)- 30kcals
Grapes seedless	60	1 small grape (3.5g)- 2kcals
Grapes seedless	60	10 grapes- 21kcals
Grapes seedless	60	20 grapes- 42kcals
Guava	26	1 medium (55g)- 14kcals
Kiwi	49	1 medium (60g)- 29kcals
Kumquats	43	1 average (19g)- 8kcals
Lychees	58	1 average (8g)- 5kcals
Mangoes	57	1 slice (40g)- 23kcals
Mangoes	57	1 cup- cubes (165g)- 94kcals
Mangoes	57	1 fruit (230g)- 131kcals
Melon- Honeydew	28	1 average slice (130g)- 36kcals
Melon- Honeydew	28	1 cup diced (177g)- 50kcals
Melon- Watermelon	31	1 cup diced (154g)- 48kcals
Melon- Watermelon	31	Average slice (250g)- 78kcals
Nectarines	40	Small (70g)- 28kcals
Nectarines	40	Medium (110g)- 44kcals
Nectarines	40	Large (150g)- 60kcals
Oranges	37	Small (120g)- 44kcals
Oranges	37	Medium (160g)- 59kcals
Oranges	37	Large (210g)- 78kcals
Papaya	36	½ papaya (200g)- 72kcals
Papaya	36	½ cup- cubes (80g)- 29kcals
Passion fruit	36	1 average (30g)- 11kcals
Peaches	33	Small (70g)- 23kcals
Peaches	33	Medium (110g)- 36kcals
Peaches	33	Large (150g)- 50kcals
Pears	40	1 small (115g)- 46kcals
Pears	40	1 medium (160g)- 64kcals

Pineapple	41	1 ring slice (40g)- 16kcals
Pineapple	41	1 cup- chunks (165g)- 68kcals
Plums	36	Small (30g)- 11kcals
Plums	36	Medium (55g)- 20kcals
Plums	36	Large (85g)- 31kcals
Pomegranate	51	½ cup (87g)- 44kcals
Pomegranate	51	1 medium fruit (120g)- 61kcals
Raspberries	25	1 raspberry (4g)- 1 kcal
Raspberries	25	10 raspberries (40g)- 10kcals
Raspberries	25	20 raspberries (80g)- 20kcals
Redcurrants	21	1 cup (112g)- 24kcals
Rhubarb- stewed	7	
Satsuma	36	Small (50g)- 18 kcals
Satsuma	36	Medium (70g)- 25kcals
Satsuma	36	Large (90g)- 32kcals
Sharon fruit	73	1 fruit (110g)- 80kcals
Strawberries	27	Small (12g)- 3kcals
Strawberries	27	Medium (26g)- 7kcals
Strawberries	27	1 cup, halves (40g)- 11kcals
Sultanas	275	Sun maid box (28.3g)- 78kcals
Sultanas	275	1 tablespoon (18g)- 50kcals
Tangerines	35	Small (50g)- 18kcals
Tangerines	35	Medium (70g)- 25kcals
Tangerines	35	Large (90g)- 32kcals

Vegetables

Table 1.4: Vegetables per 100g and per serving/ item

ITEM	Calories (Kcal) per 100g/ml weight	Per serving/ item
	VEGETABLES	
Artichoke- boiled	18	
Asparagus- boiled	26	1 spear (20g)- 5kcals
Asparagus- boiled	26	5 Spears (100g)- 26kcals
Aubergine- raw	15	Average slice (12g)- 2kcals
Aubergine- raw	15	Average portion (45g)- 7kcals
Beans- Green/ French	22	1 tablespoon (20g)- 4kcals
Beans- green/ French	22	4 tablespoons (80g)- 18kcals
Beans- runner	18	1 tablespoon (20g)- 4kcals
Beans- runner	18	4 tablespoons (80g)- 14kcals
Beans- spring green	20	1 tablespoon (20g)- 4kcals
Beans- spring green	20	4 tablespoons (80g)- 16kcals
Beansprouts raw	31	1 tablespoon (16g)- 5kcals
Beansprouts raw	31	4 tablespoons (70g)- 22kcals
Beetroot- boiled	46	½ small beet (35g)- 16kcals
Beetroot- pickled	28	1 slice (13g)- 4kcals
Beetroot- pickled	28	½ small beet (35g)- 10kcals
Beetroot- raw	36	1 beet (80g)- 29kcals
Broccoli boiled	24	2 spears (90g)- 22kcals
Broccoli- boiled	24	1 spear (45g)- 11kcals
Broccoli- purple sprouting boiled	19	
Brussel sprouts- boiled	35	1 Brussel sprout (21g)- 7kcals
Brussel sprouts- boiled	35	8 Brussel sprouts (166g)- 58kcals
Cabbage- boiled	16	3 heaped tablespoons (80g)- 13kcals
Cabbage- red, raw	26	1 cup shredded (78g)- 20kcals
Cabbage- savoy boiled	17	
Cabbage- white boiled	14	
Cabbage, Chinese pak choi raw	12	Large leaf (40g)- 5kcals
Cabbage, Chinese pak choi raw	12	1 cup shredded (80g)- 10kcals
Capers	13	1 tablespoon (8.6g)- 1kcal
Carrots- boiled	24	1 heaped tablespoon (30g)- 7kcals
Carrots- boiled	24	1 baby carrot (36g)- 9kcals
Carrots- boiled	24	1 medium carrot (80g) 19kcals
Cauliflower	28	1 floret (20g)- 6kcals

Cauliflower	28	4 florets (80g)- 22kcals
Celeriac- boiled	15	
Celery	7	1 stick (60g)- 4kcals
Chard- boiled	20	
Courgette- boiled	19	Per slice (10g)- 2kcals
Courgette- boiled	19	Small portion (40g)- 8kcals
Courgette- boiled	19	Medium portion (80g)- 15kcals
Courgette- raw	18	Per slice (10g)- 2kcals
Courgette- raw	18	Small portion (40g)- 7kcals
Cucumber	10	1 slice (7g)- 1kcal
Cucumber	10	¼ cucumber (150g)- 15kcals
Curly kale- boiled	24	1 cup chopped (130g)- 31kcals
Fennel	12	1 bulb (87g)- 10kcals
Fennel	12	1 cup, sliced (87g)- 10kcals
Garlic	98	1 clove (3g)- 3kcals
Gherkin raw, plain	12	1 average 3 inch (25g) 3kcals
Gherkins raw, plain	12	1 large (100g)- 12kcals
Gherkins- pickled and drained	14	1 average 3 inch (25g)- 4kcals
Gherkins- pickled and drained	14	1 large (100g)- 14kcals
Karela or gourd	11	
Leeks- boiled	21	½ leek (80g)- 17kcals
Lettuce- Cos	16	Cereal bowl (80g)- 13kcals
Lettuce- Cos	16	1 average leaf (25g)- 4kcals
Lettuce- Iceberg	13	Small portion (25g)- 3 kcals
Lettuce- iceberg	13	1 cereal bowl (80g) 10kcals
Lettuce- rocket	28	1 cup (30g)- 8kcals
Lettuce- rocket	28	1 cereal bowl (80g)- 22kcals
Mange tout- boiled	26	1 average (4g)- 1kcal
Mange tout- boiled	26	1 handful, 20 peas (80g)- 21 kcals
Marrow- boiled	9	
Mushrooms	13	1 average (16g)- 2kcals
Mushrooms	13	1 cup sliced (70g)- 9kcals
Mushrooms- boiled	11	Tablespoon (9.8g)- 1kcal
Mushrooms- boiled	11	1 cup, sliced (156g) 17kcals
Okra- boiled	28	
Onions	36	1 slice (15g)- 5kcals
Onions	36	1 small onion (60g)- 22kcals
Onions- red	34	1 slice (15g)- 5kcals
Onions- red	34	1 small (60g)- 20kcals
Onions- red	34	1 medium (150g)- 51kcals
Onions- Shallots	20	
Onions- spring	23	1 average (10g)- 2kcals
Parsnips- roasted in oil	124	1 tablespoon (20g)- 25kcals
Peppers- green	15	1 slice (8g)- 1kcal

Peppers- green	15	1 ring slice (12g)- 2kcals
Peppers- green	15	½ pepper (80g)- 12kcals
Peppers- green chilli	20	1 average pepper (20g)- 4kcals
Peppers- Jalapeno	21	1 piece (5g)- 1kcal
Peppers- Jalapeno	21	7 pieces (35g)- 7kcals
Peppers- red	32	1 slice (8g)- 3kcals
Peppers- red	32	1 ring slice (12g)- 4kcals
Peppers- red	32	½ pepper (80g)- 26kcals
Peppers- red chilli	26	1 average (20g)- 5kcals
Peppers- yellow	26	1 slice (8g)- 2kcals
Peppers- Yellow	26	1 ring slice (12g)- 3kcals
Peppers- yellow	26	½ pepper (80g)- 21kcals
Pumpkin- boiled	13	1 cup (245g)- 32kcals
Radish	12	
Spinach- boiled	19	
Spinach- raw	25	1 cereal bowl (80g) 20kcals
Swede- boiled	11	1 tablespoon (27g)- 3kcals
Sweetcorn- kernels	111	3 heaped tablespoons (66g)- 73kcals
Tomato puree	76	1 teaspoon (17g)- 13kcals
Tomato puree	76	1 tablespoon (51g)- 39kcals
Tomatoes	17	1 small (85g)- 14kcals
Tomatoes	17	1 large beef (280g)- 48kcals
Tomatoes- cherry	18	1 cherry (12g)- 2kcals
Tomatoes- cherry	18	10 cherry (120g)- 22kcals
Tomatoes- sundried in oil	495	1 piece (6g)- 30kcals
Tomatoes- tinned	16	1 can (400g)- 64kcals
Turnip- boiled	12	1 tablespoon, cubed (27g)- 3kcals
Turnip- boiled	12	3 tablespoons (80g)- 10kcals
Watercress	22	1 cup (30g)- 7kcals
Watercress	22	1 cereal bowl (80g)- 18kcals

Flavourings

You can use the following flavourings as much as you like:

- Lemon juice
- Fresh or dried herbs and spices
- Black pepper
- Mustard/ horseradish
- Vinegars, e.g red or white vinegar, balsamic vinegar or rice wine vinegar
- Fresh or pre- chopped garlic or ginger
- Chilli- fresh, powdered or dried flakes
- Soy sauce/ low-salt soy sauce
- Miso paste
- Fish sauce
- Worcester sauce

Low- calorie drinks

Drink plenty on your two restricted days, aim for 2 litres (4 pints) from the list below to prevent dehydration, constipation and headaches, and to keep hunger pangs at bay:

- Tea and coffee (black or add milk as required from your daily milk allowance, use sweeteners as required).
- Flavoured sugar-free sparkling water- make sure you check the label and avoid brands containing added sugar
- Sugar-free or no- added- sugar fruit- flavoured squash made up with still or sparkling water. Avoid "high juice" varieties because they contain natural fruit sugars; instead choose added- sugar varieties sweetened with artificial sweeteners
- Fruit, herbal or green teas
- Diet, sugar- free or no- added- sugar fizzy drinks Grated ginger in boiling water (and sweeteners as required). Drink hot or cold
- Slice of lemon or lime in boiling water

You can sweeten all drinks with artificial sweeteners as required. Do not add sugar.

****No Alcohol on the two restricted days!**

Snack ideas for the two restricted days

- Olives
- Handful of nuts (not chestnuts)
- Fruit from the allowed list (only one per day)
- Vegetable crudités, such as celery, cucumber, green peppers only, mangetout, spring onion, and cherry tomatoes, with salsa, low- fat hummus, tuna pate, dips
- Plain or diet yoghurt
- Bowl of soup
- Salad or cooked vegetables with cottage cheese, low- fat cream cheese or hummus
- Half a pot of cottage cheese
- Smoothie made with yoghurt, skimmed milk or semi- skimmed milk and one piece of fruit
- Half a tin of sardines or pilchards
- Sauteed tofu or chicken strips lightly fried in spices
- Boiled egg
- Avocado, mozzarella, tomato and basil skewers or stacks
- Celery sticks filled with low- fat cream cheese
- Asparagus spears dipped in egg
- Sugar- free jelly
- Ice lolly made with frozen, diluted, sugar- free squash

The vegetarian 2- day diet

There are some vegetarian sources of protein you need to be aware of because they contain carbohydrates and you will need to eat slightly less dairy foods since these also contain carbohydrates. However you can have generous amounts of eggs and tofu within your daily calorie amount. Below is a list of protein and dairy sources to limit while on the restricted two days

Protein

Protein
***Vegetarian sausage/ burger with <5g carbohydrates**
Textured vegetable protein, uncooked
Soya beans (Frozen or cooked)
Low- fat hummus
Tempeh
Quorn mince/pieces or fillet
Damame beans (frozen or cooked)

* Avoid burgers and fillets with a breadcrumb coating as these will be higher in carbohydrates

Dairy

Be aware that dairy foods contain carbohydrates so to try to limit the amount on your two restricted days.

- Reduced- fat cheddar
- Feta
- Mozzarella
- Bavarian smoked cheese
- Camembert
- Edam
- Ricotta
- Reduced- fat Halloumi

Make sure that you include the allowance of fat, vegetables and fruit on your restricted days.

Tips:

- No high- carbohydrate foods such as bread, pasta, rice, potatoes, cakes or sweets are allowed on the two restricted days
- No alcohol
- To get the full benefit of the two restricted days make sure you do consecutive days (one day after the other).
- You can change the two restricted days each week if you prefer.

Standard weights and measures guide

1 Ounce	**28.35g**
1 pound	**453.6g**
1 gram	**0.0353oz**
1 Kilogram	**2.20516lb**
1 Fluid ounce	**28.41ml**
1 Pint	**568.3ml**
1 Litre	**1.76 Pints**
1 Teaspoonful	**1/8 fl oz = about 5ml**
1 Dessertspoonful	**¼ fl oz = about 10ml**
1 Tablespoonful	**½ fl oz = about 15ml**

* Set by the food standards agency food.gov.uk

**Recipes were also given to participants.

A9- Daily Mediterranean diet- DRMD

Mediterranean plan.

This plan is made up of the following macronutrients (Carbohydrates, Protein and fats):

- 45/ 50% carbohydrates, 20-25% protein and 30% fat (15% monounsaturated fats, 8% polyunsaturated fats and 7% saturated fatty acids)
- Myfitnesspal App downloaded to your phone, Ipad or computer will track your calories and percentages of fats, carbohydrates and protein to ensure you stay within the recommended amounts.

You will be given your personal calorie allowance on induction with your interventionist.

Calorie progress chart- Mediterranean plan

Date:	Kg	Stone and pounds
Start weight		

1st Stone weight loss goal	Calories (Kcal)
Calories given	
Carbohydrates	
Protein	
Fat	

Weight loss progress chart

1 stone												
13 ½												
13												
12 ½												
12												
11 ½												
11												
10 ½												
10												
9 ½												
9												
8 ½												
8												
7 ½												
7												
6 ½												
6												
5 ½												
5												
4 ½												
4												
3 ½												
3												
2 ½												
2												
1 ½												
1												
½												
Weeks	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**

Plot your weight loss weekly or every four weeks after your appointment with your interventionist.

Protein foods

Include:

- White or oily fish and seafood
- Chicken, turkey or duck (cooked without skin)
- Lean cuts of meat- for example beef, pork, lamb or offal, lean game, venison, rabbit or pheasant (Keep to a minimum of once a week)
- Pulses, beans, chickpeas and lentils- use these for bulking up dishes
- Low- fat processed meats, bacon, ham and salty fish such as kippers, smoked salmon, smoked mackerel and smoked white fish
- Eggs- Unlimited amounts

Limit to once a week

- Fatty cuts of red meat, poultry and game (these are high in saturated fats)
- High- processed meat products (for example sausage and corned beef- these are high in saturated fat and salt)
- Battered / breaded fish (these are higher in calories and much lower in protein than uncoated fish).
- Low- fat processed meats, bacon, ham and salty fish such as kippers, smoked salmon, smoked mackerel and smoked white fish to limit your overall salt intake

Table 1 gives you a break down on calories per 100g and per serving to help you stay within your limit.

Table 1: Protein calories per 100g and per serving/item

ITEM	Calories (Kcal) per 100g/ml weight	Per serving/ item
	PROTEIN	
FISH		
Cod -steamed	83	Medium fillet (120g)- 100kcals
Cod- steamed	83	Large fillet (175g)- 145kcals
Crab boiled	128	
Haddock grilled- raw	104	Small (50g)- 52kcals
Haddock grilled- raw	104	Medium (120g)- 125kcals
Haddock poached- raw	113	
Haddock smoked- poached raw	134	
Haddock smoked- steamed raw	101	Average 150g- 152kcals
Haddock steamed	89	Average 150g- 134kcals
Hake grilled- raw	113	1 average steak 100g- 113kcals
Halibut grilled- raw	121	1 Average 145g- 175kcals
Herring grilled	181	Small fillet (85g)- 154kcals
Herring grilled	181	Medium fillet (119g)- 215kcals
Kipper baked	205	Small fillet (85g)- 174kcals
Kippers- baked	205	Medium fillet (130g)- 267kcals
Kippers- baked	205	Large fillet (170g)- 349kcals
Kippers grilled with bones	161	
Lemon sole grilled- raw	97	Small (120g)- 116kcals
Lemon sole grilled- raw	97	Medium (170g)- 165kcals
Lemon sole grilled- raw	97	Large (220g)- 213kcals
Lemon sole steamed	91	Small (120g)- 109kcals
Lemon sole- steamed	91	Medium (170g)- 155kcals
Lemon sole- steamed	91	Large (220g)- 200kcals
Mackerel canned in brine	237	Small can (180g)- 427kcals
Mackerel canned in brine	237	Large can (390g)- 924kcals
Mackerel grilled with bones- skin	220	Average portion (160g)- 352kcals
Mackerel in tomato sauce	206	Average can (125g)- 258kcals
Mackerel- grilled	239	1 small fillet (50g)- 120kcasl
Mackerel grilled	239	1 medium fillet (80g)- 191kcals
Mackerel- smoked	354	1 small fillet (100g)- 354kcals
Mackerel- smoked	354	1 medium fillet (150g)- 531kcals
Monkfish grilled- raw	96	Average portion (70g)- 67kcals
Mussels boiled	104	1 mussel(7g)- 7kcals
Plaice grilled- raw	96	Small fillet (75g)- 72kcals

Plaice grilled- raw	96	Medium fillet (130g)- 125kcals
Plaice grilled- raw	96	Large fillet (173g) 173kcals
Prawns- boiled	99	1 shrimp (3g)- 3kcals
Prawns- boiled	99	1 king-tiger prawn (8g)- 8kcals
Salmon steak grilled -raw	215	1 average dame (100g) 215kcals
Salmon steak grilled- raw	215	1 large dame (190g)- 409kcals
Salmon steak grilled- raw	215	1 average cutlet/ steak (210g)- 452kcals
Salmon steamed- raw	194	1 average dame (100g) 194kcals
Salmon steamed- raw	194	1 large dame (190g)- 369kcals
Salmon steamed- raw	194	1 average cutlet/steak (210g)- 407kcals
Salmon steamed with bones-skin	150	1 average dame (100g) 150kcals
Salmon steamed with bones-skin	150	1 large dame (190g)- 285kcals
Salmon steamed with bones-skin	150	1 average cutlet/steak (210g)- 315kcals
Salmon- Baked	204	1 average dame (100g)- 204kcals
Salmon- baked	204	1 large dame (190g)- 388kcals
Salmon- baked	204	1 average cutlet/steak (210g)- 428kcals
Salmon- red canned in brine	153	Small can (105g)- 161kcals
Salmon- red canned in brine	153	Medium can (201g)- 321kcals
Salmon- Smoked	142	
Sardines canned in brine	172	1 sardine (25g)- 43kcals
Sardines grilled- whole	195	1 sardine (15g)- 29kcals
Sardines grilled- whole	195	Average portion (80g)- 156kcals
Sardines in spring water	182	1 sardine (25g)- 46kcals
Sardines in spring water	182	Average portion (85g)- 155kcals
Sardines in tomato sauce	162	1 sardine (25g)- 41kcals
Scallops steamed	118	
Sea bass or bream	124	
Swordfish grilled- raw	139	Average portion (140g)- 195kcals
Trout grilled	135	Average portion 60g- 81 kcals
Trout smoked	135	Average portion (60g)- 81 kcals
Tuna in brine	99	Small -100g (drained 72g)- 99kcals
Tuna in brine	99	Standard can 180g (drained 130g)- 129kcals
CHICKEN		
Chicken breast fillet	148	Pieces (45g)- 67kcals
Chicken breast fillet	148	Small fillet (90g)- 133kcals
Chicken breast fillet	148	Medium fillet (120g)- 178kcals

Chicken dark meat roasted	196	
Chicken drumsticks- no skin	152	1 small (35g)- 53kcals
Chicken drumstick- no skin	152	1 medium (45g)- 68kcals
Chicken drumstick- no skin	152	1 large (60g)- 91kcals
Chicken light meat- roasted	153	1 breast slice (40g)- 61 kcals
Chicken light meat- roasted	153	Small portion (70g)- 107kcals
PORK		
Bacon medallions	130	33kcals per 25g medallion
Bacon rashers grilled	307	20g- 61kcals
Bacon- streaky	337	20g, 1 slice -67kcals
Gammon joint boiled	204	1 med slice 130g- 265kcals
Gammon Steak grilled	209	
Pork loin chops	241	1 small (70g)- 169kcals
Pork loin chops	241	1 medium (136g)- 328kcals
Pork loin joint- roasted	253	1 thin slice (60g)- 152kcals
Pork loin joint- roasted	253	1 medium slice (130g)- 329kcals
Pork mince raw	164	
BEEF		
Beef braising steak- lean	246	1 average 5oz (103g)- 253kcals
Beef brisket- boiled	268	1 average piece (290g)- 777kcals
Beef fillet steak- grilled med-rare	200	5oz (103g)- 182kcals
Beef fillet steak- grilled med/rare	200	8oz (172g)- 344kcals
Beef mince- extra lean raw	174	
Beef- sirloin steak- grilled med/rare	176	5oz (103g)- 181kcals
Beef sirloin steak- grilled med/rare	176	8oz (172g)- 302kcals
Beef stewing steak- lean	203	
Beef topside- roasted med/rare	175	Thin slice (28g)- 50kcals
Beef topside- roasted med/rare	175	Thick slice (45g)- 79kcals
Rump lean- grilled	177	5oz (103g)- 182kcals
Rump lean- grilled	177	8oz (166g) 294kcals
OTHER MEATS		
Rabbit- stewed	114	½ rabbit (225g)- 257kcals
Venison- roasted	165	Average portion (120g)- 198kcals
Pheasant – roasted	220	1 Pheasant (430g)- 946kcals
Pigeon- roasted	187	1 Pigeon (115g)- 215kcals

Partridge- roasted	212	1 partridge (260g)- 551kcals
OFFAL		
Chicken Liver- raw	92	1 liver (44g)- 40kcals
Lambs Liver- raw	137	1 portion (85g)- 116kcals
Lambs liver-raw	137	1 liver (322g)- 441kcals
Ox Liver- raw	155	1 slice (50g)- 78kcals
Oxtail- stewed	243	
Pigs Liver raw	113	
VEGETARIAN		
Edamame beans boiled	122	½ cup (80g)- 97kcals
Hummus	297	1 teaspoon (10g)- 30kcals
Hummus	297	1 tablespoon (30g)- 89kcals
Hummus- reduced fat	187	1 teaspoon (10g)- 19kcals
Hummus- reduced fat	187	1 tablespoon (30g)- 56kcals
Quorn mince	105	1 serving (75g)- 79 kcals
Quorn mince	105	1 cup (100g)- 105kcals
Soya beans dried- boiled	141	1 tablespoon (10.7g)- 15kcals
Soya beans dried- boiled	141	1 cup (175g)- 247kcals
Tofu raw	76	¼ block 116g- 88kcals
Tofu raw	76	½ cup (125g)- 95kcals
Tofu raw	76	1 cup (250g)- 190kcals
Eggs boiled or poached	147	1 egg 50g- 74kcals
Eggs boiled or poached	147	1 large egg (57g)- 84 kcals
Eggs boiled or poached	147	1 jumbo egg (65g)- 96kcals

Carbohydrates

- Choose wholegrain varieties whenever possible because they contain more fibre and nutrients compared to processed or white versions, take longer to digest and absorb, and can make you feel fuller for longer.
- Cut down as much as possible on white, refined carbohydrates
- Try to avoid foods high in sugar such as cakes, biscuits and sweets because these carbohydrates can cause raised blood sugar and insulin levels, which can increase appetite and leave you craving for more!

Table 1.1 lists carbohydrates recommended and those to avoid/ limit intake

Table 1.1 List of carbohydrates recommended while following the nutrition plan and those to limit/ avoid

	Carbohydrates recommended	Carbohydrates to avoid as much as possible
Bread	Granary bread, pitta bread, pumpernickel bread, multigrain bread, rye bread, wholemeal bread	White bread, French stick, bagels, croissants, crumpets
Rice and pasta	Basmati rice, bulgar wheat, quinoa, brown rice, brown noodles, wholewheat pasta, brown couscous, brown rice	White rice, couscous, noodles
Breakfast cereals	Porridge, bran flakes, high-fibre bran cereal, wholewheat bisks, no-added-sugar muesli	Cornflakes, white rice cereal such as rice crispies, sugary cereals such as frosties, coco pops, instant oat cereal for example oat so simple
Snacks	Yoghurts, nuts, plain popcorn	Crisps, sweets, biscuits, sugary popcorn, donuts, cakes
Potatoes	Sweet potatoes, new potatoes boiled or steamed in their skins, jacket potatoes	Mashed potato, chips
Crackers	Oatcakes, rye crispbreads, wholewheat crackers	Cream crackers, rice cakes
Drinks	Water, sugar- free squash, diet fizzy drinks	Sugary fizzy drinks, alcohol

Table 1.2 Carbohydrate calories per 100g and per serving/item

ITEM	Calories (Kcal) per 100g/ml weight	Per serving/ item
	CARBOHYDRATES	RECOMMENDED
BREAD AND CRACKERS		
Bread- Brown	207	1 medium slice (37g)- 77kcals
Bread- Granary	237	Medium (37g)- 88kcals
Bread- Granary	237	Thick (46g)- 109kcals
Bread- Hovis granary	241	1 slice (44g)- 106kcals
Bread- White	235	1 Medium slice (36g)- 85kcals
Crackers- wholemeal	414	Average (67g) 178kcals
Oatcakes- Nairn	436	1oatcake (9.6g)- 42kcals
Pitta bread- wholemeal	265	1 mini pitta (35g)- 93kcals
Pumpernickel	250	1 Average slice (29g)- 73kcals
Rolls- Crusty brown	255	Average roll (66g)- 155kcals
Rolls- soft brown	236	
Rolls- Wholemeal	244	
Rye bread	219	1 average slice (72g)- 158kcals
Ryvita- Multigrain	370	1 crispbread (11g)- 41kcals
Ryvita- Pumpkin seed and oats	384	1 crispbread (12g) 46kcals
Ryvita- Wholegrain	379	1 crispbread (5g)- 19kcals
Tortilla wrap- white	304	1 average wrap (60g) 182kcals
Tortilla wraps- Wholemeal	314	1 average wrap (60g)- 188kcals
RICE		
Basmati- brown (boiled)	114	1 cup (180g)- 205kcals
Basmati- brown (dry)	338	¼ cup (50g)- 169kcals
Basmati- brown (dry)	338	½ cup (100g)- 338kcals
Basmati- White (boiled)	122	1 cup (180g) 220kcals
Basmati- white (dry)	363	½ cup (90g)- 327kcals
Basmati- white (dry)	363	1 cup (180g)- 653kcals
Brown (boiled)	141	1 cup (180g)- 254kcals
Brown (dry)	357	¼ cup (50g)- 179kcals
Brown (dry)	357	½ cup (100g)- 357kcals
PASTA		
Bulgur wheat (dry)	353	1 cup (140g)- 494kcals
Bulgur wheat (dry)	353	½ cup (70g)- 247kcals
Noodle wholemeal dry	369	1 cup- (57g)- 210kcals
Pasta twists cooked	145	150g- 218kcals
Pasta twists cooked	145	230g- 334kcals
Pasta wholemeal dry	328	1 cup (95g)- 312kcals

Quinoa cooked	184	½ cup (120g)- 221kcals
Quinoa dry	368	½ cup (90g)- 331kcals
Spaghetti wholemeal cooked	113	150g- 170kcals
Spaghetti wholemeal cooked	113	220g- 249kcals
Spaghetti wholemeal dry	324	88g- 285kcals
Spaghetti wholemeal dry	324	60g- 194kcals
Spaghetti wholewheat cooked	132	220g- 290kcals
Spaghetti wholewheat cooked	132	150g- 198kcals
Spaghetti- wholewheat dry	326	88g- 287kcals
Spaghetti- wholewheat dry	326	60g- 196kcals
BREAKFAST CEREALS		
All Bran	270	½ cup (40g)- 108kcals
All Bran	270	1 cup (80g)- 216kcals
Bran flakes	330	Small bowl (30g)- 99kcals
Bran flakes	330	Medium bowl (45g)- 149kcals
Fruit and fibre	353	Small bowl (29g)- 102kcals
Fruit and fibre	353	Medium bowl (50g)- 177kcals
Fruit and fibre	353	Large bowl (75g)- 265kcals
Muesli- no added sugar	366	Small bowl (30g)- 110kcals
Muesli- no added sugar	366	Med bowl, ½ cup (45g) -165kcals
Muesli- no added sugar	366	Large bowl, 1 cup (95g)- 348kcals
Oatibix	394	1 biscuit (24g)- 95kcals
Oatibix	394	2 biscuits (48g)- 189kcals
Porridge made with water	46	220g- 101kcals
Porridge with whole milk	113	220g- 249kcals
Porridge- semi skimmed milk	94	220g- 207kcals
Porridge- water and milk	80	220g- 176kcals
Rolled oats dry	401	½ cup (40g)- 160kcals
Shredded wheat	332	1 biscuit (22g)- 73kcals
Special K	376	Small bowl (30g)- 133kcals
Special K	376	1 cup (35g)- 132kcals
Special K	376	1 large bowl (58g)- 218kcals
Weetabix	352	1 Bisk (20g)- 70kcals
POTATOES		
Jacket potato	136	Small (100g)- 136kcals
Jacket potato	136	Medium (180g)- 245kcals
New potatoes boiled in skins	66	1 small (16g)- 11kcals
New potatoes boiled in skins	66	1 medium (42g)- 28kcals
New potatoes boiled in skins	66	1 Large (80g)- 53kcals
Old potatoes roasted- olive oil	111	80g- 89kcals
Old potatoes roasted- olive oil	111	160g- 178kcals
Old potatoes roasted- olive oil	111	240g- 266kcals

Old potatoes- boiled	72	1 Average (135g)- 97kcals
Sweet potatoes raw	87	1 small (135g)- 117kcals
Sweet potatoes raw	87	1 medium (238g)- 207kcals
Sweet potatoes raw	87	1 large (456g)- 397kcals
Sweet potato- baked	115	1 small (98g)- 113kcals
Sweet potato- baked	115	1 medium (174g)- 200kcals
SNACKS		
Nuts- See fats section		
Popcorn- low fat, low salt	429	1 handful (5g)- 22kcals
Popcorn- Plain (air popped)	387	1 handful (5g)- 19kcals
Popcorn- Plain (air popped)	387	1 standard bag (30g) 116kcals
Popcorn- Plain (oil popped)	593	1 handful (5g)- 30kcals
Yoghurts- see dairy section		
DRINKS		
Diet fizzy soft drink	3	1 standard bottle 500ml- 15kcals
Diet fizzy soft drinks	3	½ pint (284ml) – 9kcals
Diet fizzy soft drinks	3	1 can (330ml)- 10 kcals
Fruit drink- concentrated no added sugar	8	55ml- 4 kcals

Fibre- Insoluble
This is found in cereals and pulses to protect against constipation and helps to keep your bowel healthy.

Fibre- Soluble
Found in oats, barley, beans, fruit and vegetables to slow down the rate at which food empties from your stomach, slows down the absorption of nutrients,

Healthy snack suggestions are as follows:

- Oatcakes, rye crispbreads or wholemeal crackers with low-fat hummus, low-fat cream cheese or cottage cheese
- Fruit- no more than two per day
- Vegetable crudités, such as celery, cucumber, green peppers, mangetout, spring onions and cherry tomatoes, with salsa, low-fat hummus, tuna pate, dips
- Plain, diet or fruit yogurt
- Malt loaf, without margarine or low-fat spread
- Small handful of unsalted nuts or dried fruit
- Plain popcorn (popped in vegetable oil with no salt or sugar added)
- Bowl of soup (see recipe options)
- Smoothie made with skimmed or semi skimmed milk, yogurt and one piece of fruit
- Dried pea snacks
- Sugar- free jelly
- Ice lolly made from frozen, diluted, sugar- free squash

	CARBOHYDRATES TO LIMIT/ AVOID	Per serving/ item
Bread and crackers		
Bagels	273	1 mini (26g)- 71kcals
Bagels	273	1 small (45g)- 123kcals
Bagels	273	1 average (90g)- 246kcals
Cream crackers	414	1 cracker (7g)- 29kcals
Croissants	373	1 mini croissant (35g)- 131kcals
Croissants	373	1 croissant (60g)- 224kcals
Crumpets	207	1 piece (45g)- 93kcals
Crumpets	207	2 pieces (90g)- 186kcals
Crusty- white	243	Medium slice (35g)- 85kcals
Crusty- white	243	Large slice (50g)- 122kcals
French stick- white	263	1 inch, 2.3cm (14g)- 37kcals
French stick- white	263	Small 6 inch roll, 15cm (80g)- 210kcals
Pitta- white	255	Mini pitta (35g)- 89kcals
Pitta- white	255	Average oval pitta (67g)- 171kcals
Rice cakes	331	1 rice cake (9g)- 30kcals
White bread	235	Thin slice (31g)- 73kcals
White bread	235	Medium slice (36g)- 85kcals
White bread	235	Thick slice 944g)- 103kcals
Rice		
Couscous- cooked	227	
Couscous- dry	365	1 cup (173g)- 163kcals

Easy cooked white- cooked	138	1 tablespoon (40g)- 55kcals
Easy cook white- cooked	138	1 cup (180g)- 248kcals
Easy cook white- uncooked	383	1 serving (65g)- 249kcals
Easy cook white- uncooked	383	½ cup (90g)- 345kcals
Easy cook white- uncooked	383	1 cup (180g)- 689kcals
Pasta		
Noodles, plain- cooked	62	Average serving (280g)- 174kcals
Noodles, plain- uncooked	388	
Breakfast cereals		
Cheerios'	368	1 tablespoon (5g)- 18kcals
Cheerio's	368	Small serving (25g)- 92kcals
Cheerio's	368	Medium serving (35g)- 129kcals
Clusters	387	
Coco pops	383	1 tablespoon (7g)- 27 kcals
Coco pops	383	½ cup (18g)- 69kcals
Coco pops	383	1 cup (35g)- 134kcals
Cornflakes	376	Small bowl (23g)- 86kcals
Cornflakes	376	1 cup/ Medium bowl (35g)- 132kcals
Cornflakes	376	Large bowl (58g)- 218kcals
Frosties	381	1 tablespoon (8g)- 30kcals
Frosties	381	Medium portion (30g)- 114kcals
Honey loops	370	1 tablespoon (5g)- 19kcals
Honey loops	370	Small serving (25g)- 93kcals
Honey loops	370	Medium serving (35g)- 130 kcals
Oats so simple- original	370	1 sachet (27g)- 100kcals
Oats so simple- golden syrup	376	1 sachet (36g) 135kcals
Oats so simple- Honey almond	379	1 sachet (33g)- 129kcals
Rice Krispies	382	1 tablespoon (4g)- 15kcals
Rice Krispies	382	½ cup (14g)- 53kcals
Rice Krispies	382	1 cup (30g)- 115kcals
Rice Krispies	382	2 cups (60g)- 229kcals
Shreddies	346	Small bowl (28g)- 97kcals
Shreddies	346	Medium bowl (56g)- 194kcals
Sugar puffs	381	1 tablespoon (6g)- 23kcals
Sugar puffs	381	1 cup (30g)- 114kcals
Weetos	372	1 Tablespoon (5g)- 19kcals
Weetos	372	Medium serving (35g)- 130kcals
Potatoes		
Chips- frozen and oven baked	162	Small portion (80g)- 130kcals
Chips- frozen and oven baked	162	Medium portion (135g)- 219kcals

Mashed- low fat milk	68	1 tablespoon (45g)- 31kcals
Mashed- Low fat milk	68	1 cup (210g)- 143kcals
Mashed- with margarine	104	1 tablespoon (45g)- 47kcals
Mashed- with margarine	104	1 cup (210g)- 218kcals
Mashed- with milk and low fat spread	74	1 tablespoon (45g)- 33kcals
Mashed- with milk and low fat spread	74	1 cup (210g)- 155kcals
Snacks- biscuits		
Belvita	450	1 biscuit (12.5g)- 56kcals
Belvita	450	1 pack (50g)- 225kcals
Cookies- chocolate chip	474	1Mayland biscuit (9g)- 43kcals
Cookies- chocolate chip	474	1 Boasters biscuit (19g)- 90kcals
Crunch biscuits- cream filled	497	1 biscuit (11g)- 55kcals
Digestive- chocolate	493	1 biscuit (16g)- 79kcals
Digestive- chocolate	493	3 biscuits (48g)- 237kcals
Digestive- plain	465	1 biscuit (14g)- 65kcals
Fig roll	365	1 fig roll (21g)- 77kcals
Flapjacks	493	
Gingernuts	436	1 biscuit (10g)- 44kcals
Oreo biscuit	478	1 Oreo (11g)- 53kcals
Oreo biscuit	478	1 mini Oreo (3.1g)- 15kcals
Rich tea	427	1 biscuit (7g)- 30kcals
Wafer biscuit- filled	537	1 biscuit (7g)- 38kcals
Snacks- cakes		
Chocolate cake	464	Average 65g- 302kcals
Doughnut- ring, iced	383	1 average (65g)- 249kcals
Doughnut- ring, plain	403	1 average (60g)- 242kcals
Doughnuts- custard	358	1 average (65g)- 233kcals
Doughnuts- jam	336	1 average (65g)- 218kcals
Fruit cake	322	65g- 209kcals
Jaffa cake	377	1 cake (13g)- 49kcals
Jaffa cake	377	3 cakes (39g)- 147kcals
Muffins- blueberry	377	Mini (17g)- 64kcals
Muffins- blueberry	377	Standard (75g) 283kcals
Sponge cake	467	
Swiss roll	290	65g- 189kcals
Teacakes	296	65g- 192kcals
Snacks- crisps		
Crisps	530	25g standard bag- 133kcals
Crisps- low fat	458	Standard bag (25g)- 115kcals

Mini cheddars	517	1 small bag (25g)- 129kcals
Mini cheddars	517	50g bag- 259kcals
Pringles	515	1 crisp (2g) 10kcals
Pringles	515	1 small tub (40g)- 207kcals
Snack a jacks	410	1 packet (30g)- 123kcals
Snacks- sweets		
Boiled sweets	327	1 sweet (5g)- 16kcals
Jelly beans	375	1 jellybean (1.3g)- 5kcals
Jelly beans	375	10 jellybeans (13g)- 49kcals
Jelly tots/ fruit pastilles	327	1 sweet (4g)- 13kcals
Liquorice allsorts	349	Each sweet (5g)- 17kcals
Sherbet sweets	355	1 sweet (4g)- 14kcals
Werthers original	425	1 sweet (5.2g)- 22kcals
Sugary fizzy drinks		
7 up	22	½ pint (284ml)- 62kcals
Lemonade	22	½ pint (284ml)- 62kcals
Pepsi	44	½ pint (284ml)- 125kcals

Table 1.3 Fats and calories per 100g and per serving/ item

ITEM	Calories (Kcal) per 100g/ml weight	Per serving/ item
	FATS	
LOW FAT SPREADS		
Margarine- flora light/ pro active	347	5g, 1 teaspoon- 17kcals
Margarine- low fat	350	9g, 1 teaspoon- 32kcals
OILS		
Olive oil	899	1 teaspoon (4.2g)- 38kcals
Rapeseed oil	899	1 teaspoon (4.2g)- 38kcals
NUTS		
Almonds with skin	596	6 almonds (6g) 36kcals
Brazil nuts	683	3 brazil nuts (15g) 102kcals
Cashew nuts	573	10 cashews (18g) 103 kcals
Peanuts	564	10 peanuts (13g) 73kcals
Pistachios	601	10 pistachios (7g) 42kcals
Walnuts	688	3 walnuts (12g) 83kcals
OTHERS		
Avocado	134	½ Avocado (120g) 161kcals
Mayonnaise	691	1 teaspoon (7g) 48kcals
Mayonnaise	691	1 heaped teaspoon (15g) 104kcals
Mayonnaise	691	1 tablespoon (22g) 152kcals
Mayonnaise	691	1 heaped tablespoon (33g) 228kcals
Mayonnaise- Reduced fat	288	1 teaspoon (7g) 20kcals
Mayonnaise- reduced fat	288	1 heaped teaspoon (15g) 43kcals
Mayonnaise- reduced fat	288	1 tablespoon (22g) 63kcals
Mayonnaise- reduced fat	288	1 heaped tablespoon (33g) 95kcals
Olives in brine	103	1 olive (2g) 2 kcals
Olives in brine	103	10 olives (20g) 21kcals
Peanut butter- reduced fat	548	1 teaspoon (14g) 77kcals
Peanut butter- smooth	607	1 teaspoon (14g) 85kcals
Peanut butter- wholegrain	606	1 teaspoon (15g) 91 kcals
Pesto- Green	412	1 teaspoon (8g) 33kcals
Pesto- Green	412	1 tablespoon (26g) 107kcals
Guacamole	128	1 tablespoon (35g) 45kcals

Table 1.4 Dairy and calories per 100g and per serving/item

ITEM	Calories (Kcal) per 100g/ml weight	Per serving/ item
	DAIRY	
MILK		
Skimmed	32	200ml- 64kcals
Skimmed	32	400ml- 128kcals
Semi- skimmed	46	200ml- 92kcals
Semi-skimmed	46	400ml- 184kcals
Soya- sweetened	43	200ml- 86kcals
Soya- sweetened	43	400ml- 172kcals
Soya- unsweetened	26	200ml- 52kcals
Soya- unsweetened	26	400ml- 104kcals
Whole milk	66	200ml- 132kcals
Whole milk	66	400ml- 264kcals
CHEESE		
Camembert	290	
Cheddar	416	22g slice- 92kcals
Cheddar	416	¼ cup grated cheese(30g)- 125kcals
Cheddar ½ fat	273	Average slice (22g) 60kcals
Cheddar ½ fat	273	¼ cup grated cheese (30g)- 82kcals
Cottage cheese	101	1 Tablespoon (40g) 40kcals
Cottage cheese- reduced fat	79	1 tablespoon (40g)- 32kcals
Cottage cheese- reduced fat	79	1 cup (230g)- 182kcals
Cream cheese- low/medium fat	199	Teaspoon (17g) 34kcals
Cream cheese- low/medium fat	199	1 teaspoon (17g)- 34kcals
Cream cheese- low/ medium fat	199	1 tablespoon (51g) 101kcals
Cream cheese- extra light	111	1 teaspoon (17g)- 19kcals
Cream cheese- Extra light	11	1 tablespoon (51g)- 57kcals
Edam	341	
Feta	250	5x 1cm cube (30g) 75kcals
Halloumi	310	½ cup (70g) 217kcals
Mozzarella	257	Small ball (40g) 103kcals

Mozzarella	257	Average ball (125g) 321kcals
Mozzarella 10%	178	Small ball (40g) 71kcals
Mozzarella 10%	178	Average ball (125g) 223kcals
Parmesan	415	1 teaspoon (5g) 21kcals
Parmesan	415	1 tablespoon (15g) 62kcals
Ricotta- reduced fat	144	Teaspoon (10g) 14kcals
Ricotta- reduced fat	144	Tablespoon (30g) 43kcals
YOGHURTS		
Greek plain	133	125g 166kcals
Whole milk fruit	109	125g- 136kcals
Greek fruit- low fat	87	125g- 109kcals
Greek fruit- whole	137	125g- 171kcals
Quark	74	1 tablespoon (45g)- 33kcals
Low-fat fruit	78	125g- 98kcals
Whole milk fruit	109	125g- 136kcals
Greek 0% plain	57	125g- 71kcals
Virtually fat- free	47	125g- 59kcals

Fruit and vegetables

- Recommendations are to consume 7 portions per day- 2 fruit and 5 vegetables see table 1.6 for serving amounts. Treat fruit and vegetables as your carbohydrate calories.

Table 1.5: Fruit and calories per 100g and per serving/ item

ITEM	Calories (Kcal) per 100g/ml weight	Notes
	FRUIT	
Apples	47	
Apricots – fresh	31	1 average (40g)- 12kcals
Apricots- dried	188	1 piece (8g)- 15kcals
Apricots- dried	188	4 pieces (32g)- 60kcals
Apricots- fresh	31	4 apricots (160g)- 48kcals
Bananas	95	Small (60g)- 57kcals
Bananas	95	Medium (100g)- 95kcals
Bananas	95	Large (120g)- 114kcals
Blackberries	25	1 blackberry (5g)- 1kcal
Blackberries	25	6 blackberries (30g)- 8kcals

Blackberries	25	12 blackberries (60g)- 15kcals
Blackcurrants	28	5 blackcurrants (2g)- 1kcal
Blackcurrants	28	50 blackcurrants (20g)- 6kcals
Blackcurrants	28	80g- 22kcals
Blueberries	30	15 blueberries (30g)- 9kcals
Cherries	48	1 cherry (4g)- 2kcals
Cherries	48	10 cherries (40g)- 19kcals
Clementine peeled	37	Small (40g)- 15kcals
Clementine peeled	37	Medium (60g)- 22kcals
Clementine peeled	37	Large (80g)- 30kcals
Cranberries	15	10 average (20g)- 3kcals
Dates- dried	270	1 date (7.1g)- 19kcals
Dried mixed fruit	268	
Figs- dried	227	1 average (20g)- 45kcals
Figs- fresh	43	1 average (55g)- 24kcals
Grapefruit	30	½ average (100g)- 30kcals
Grapes seedless	60	1 small grape (3.5g)- 2kcals
Grapes seedless	60	10 grapes- 21kcals
Grapes seedless	60	20 grapes- 42kcals
Guava	26	1 medium (55g)- 14kcals
Kiwi	49	1 medium (60g)- 29kcals
Kumquats	43	1 average (19g)- 8kcals
Lychees	58	1 average (8g)- 5kcals
Mangoes	57	1 slice (40g)- 23kcals
Mangoes	57	1 cup- cubes (165g)- 94kcals
Mangoes	57	1 fruit (230g)- 131kcals
Melon- Honeydew	28	1 average slice (130g)- 36kcals
Melon- Honeydew	28	1 cup diced (177g)- 50kcals
Melon- Watermelon	31	1 cup diced (154g)- 48kcals
Melon- Watermelon	31	Average slice (250g)- 78kcals
Nectarines	40	Small (70g)- 28kcals
Nectarines	40	Medium (110g)- 44kcals
Nectarines	40	Large (150g)- 60kcals
Oranges	37	Small (120g)- 44kcals
Oranges	37	Medium (160g)- 59kcals
Oranges	37	Large (210g)- 78kcals
Papaya	36	½ papaya (200g)- 72kcals
Papaya	36	½ cup- cubes (80g)- 29kcals
Passion fruit	36	1 average (30g)- 11kcals
Peaches	33	Small (70g)- 23kcals
Peaches	33	Medium (110g)- 36kcals
Peaches	33	Large (150g)- 50kcals
Pears	40	1 small (115g)- 46kcals
Pears	40	1 medium (160g)- 64kcals

Pineapple	41	1 ring slice (40g)- 16kcals
Pineapple	41	1 cup- chunks (165g)- 68kcals
Plums	36	Small (30g)- 11kcals
Plums	36	Medium (55g)- 20kcals
Plums	36	Large (85g)- 31kcals
Pomegranate	51	½ cup (87g)- 44kcals
Pomegranate	51	1 medium fruit (120g)- 61kcals
Raspberries	25	1 raspberry (4g)- 1 kcal
Raspberries	25	10 raspberries (40g)- 10kcals
Raspberries	25	20 raspberries (80g)- 20kcals
Redcurrants	21	1 cup (112g)- 24kcals
Rhubarb- stewed	7	
Satsuma	36	Small (50g)- 18 kcals
Satsuma	36	Medium (70g)- 25kcals
Satsuma	36	Large (90g)- 32kcals
Sharon fruit	73	1 fruit (110g)- 80kcals
Strawberries	27	Small (12g)- 3kcals
Strawberries	27	Medium (26g)- 7kcals
Strawberries	27	1 cup, halves (40g)- 11kcals
Sultanas	275	Sun maid box (28.3g)- 78kcals
Sultanas	275	1 tablespoon (18g)- 50kcals
Tangerines	35	Small (50g)- 18kcals
Tangerines	35	Medium (70g)- 25kcals
Tangerines	35	Large (90g)- 32kcals

Table 1.6: Vegetables per 100g and per serving/ item

ITEM	Calories (Kcal) per 100g/ml weight	Per serving/ item
	VEGETABLES	
Artichoke- boiled	18	
Asparagus- boiled	26	1 spear (20g)- 5kcals
Asparagus- boiled	26	5 Spears (100g)- 26kcals
Aubergine- raw	15	Average slice (12g)- 2kcals
Aubergine- raw	15	Average portion (45g)- 7kcals
Beans- Green/ French	22	1 tablespoon (20g)- 4kcals
Beans- green/ French	22	4 tablespoons (80g)- 18kcals
Beans- runner	18	1 tablespoon (20g)- 4kcals
Beans- runner	18	4 tablespoons (80g)- 14kcals
Beans- spring green	20	1 tablespoon (20g)- 4kcals
Beans- spring green	20	4 tablespoons (80g)- 16kcals
Beansprouts raw	31	1 tablespoon (16g)- 5kcals
Beansprouts raw	31	4 tablespoons (70g)- 22kcals
Beetroot- boiled	46	½ small beet (35g)- 16kcals
Beetroot- pickled	28	1 slice (13g)- 4kcals
Beetroot- pickled	28	½ small beet (35g)- 10kcals
Beetroot- raw	36	1 beet (80g)- 29kcals
Broccoli boiled	24	2 spears (90g)- 22kcals
Broccoli- boiled	24	1 spear (45g)- 11kcals
Broccoli- purple sprouting boiled	19	
Brussel sprouts- boiled	35	1 Brussel sprout (21g)- 7kcals
Brussel sprouts- boiled	35	8 Brussel sprouts (166g)- 58kcals
Cabbage- boiled	16	3 heaped tablespoons (80g)- 13kcals
Cabbage- red, raw	26	1 cup shredded (78g)- 20kcals
Cabbage- savoy boiled	17	
Cabbage- white boiled	14	
Cabbage, Chinese pak choi raw	12	Large leaf (40g)- 5kcals
Cabbage, Chinese pak choi raw	12	1 cup shredded (80g)- 10kcals
Capers	13	1 tablespoon (8.6g)- 1kcal
Carrots- boiled	24	1 heaped tablespoon (30g)- 7kcals
Carrots- boiled	24	1 baby carrot (36g)- 9kcals
Carrots- boiled	24	1 medium carrot (80g) 19kcals
Cauliflower	28	1 floret (20g)- 6kcals
Cauliflower	28	4 florets (80g)- 22kcals

Celeriac- boiled	15	
Celery	7	1 stick (60g)- 4kcals
Chard- boiled	20	
Courgette- boiled	19	Per slice (10g)- 2kcals
Courgette- boiled	19	Small portion (40g)- 8kcals
Courgette- boiled	19	Medium portion (80g)- 15kcals
Courgette- raw	18	Per slice (10g)- 2kcals
Courgette- raw	18	Small portion (40g)- 7kcals
Cucumber	10	1 slice (7g)- 1kcal
Cucumber	10	¼ cucumber (150g)- 15kcals
Curly kale- boiled	24	1 cup chopped (130g)- 31kcals
Fennel	12	1 bulb (87g)- 10kcals
Fennel	12	1 cup, sliced (87g)- 10kcals
Garlic	98	1 clove (3g)- 3kcals
Gherkin raw, plain	12	1 average 3 inch (25g) 3kcals
Gherkins raw, plain	12	1 large (100g)- 12kcals
Gherkins- pickled and drained	14	1 average 3 inch (25g)- 4kcals
Gherkins- pickled and drained	14	1 large (100g)- 14kcals
Karela or gourd	11	
Leeks- boiled	21	½ leek (80g)- 17kcals
Lettuce- Cos	16	Cereal bowl (80g)- 13kcals
Lettuce- Cos	16	1 average leaf (25g)- 4kcals
Lettuce- Iceberg	13	Small portion (25g)- 3 kcals
Lettuce- iceberg	13	1 cereal bowl (80g) 10kcals
Lettuce- rocket	28	1 cup (30g)- 8kcals
Lettuce- rocket	28	1 cereal bowl (80g)- 22kcals
Mange tout- boiled	26	1 average (4g)- 1kcal
Mange tout- boiled	26	1 handful, 20 peas (80g)- 21 kcals
Marrow- boiled	9	
Mushrooms	13	1 average (16g)- 2kcals
Mushrooms	13	1 cup sliced (70g)- 9kcals
Mushrooms- boiled	11	Tablespoon (9.8g)- 1kcal
Mushrooms- boiled	11	1 cup, sliced (156g) 17kcals
Okra- boiled	28	
Onions	36	1 slice (15g)- 5kcals
Onions	36	1 small onion (60g)- 22kcals
Onions- red	34	1 slice (15g)- 5kcals
Onions- red	34	1 small (60g)- 20kcals
Onions- red	34	1 medium (150g)- 51kcals
Onions- Shallots	20	
Onions- spring	23	1 average (10g)- 2kcals
Parsnips- roasted in oil	124	1 tablespoon (20g)- 25kcals
Peppers- green	15	1 slice (8g)- 1kcal
Peppers- green	15	1 ring slice (12g)- 2kcals

Peppers- green	15	½ pepper (80g)- 12kcals
Peppers- green chilli	20	1 average pepper (20g)- 4kcals
Peppers- Jalapeno	21	1 piece (5g)- 1kcal
Peppers- Jalapeno	21	7 pieces (35g)- 7kcals
Peppers- red	32	1 slice (8g)- 3kcals
Peppers- red	32	1 ring slice (12g)- 4kcals
Peppers- red	32	½ pepper (80g)- 26kcals
Peppers- red chilli	26	1 average (20g)- 5kcals
Peppers- yellow	26	1 slice (8g)- 2kcals
Peppers- Yellow	26	1 ring slice (12g)- 3kcals
Peppers- yellow	26	½ pepper (80g)- 21kcals
Pumpkin- boiled	13	1 cup (245g)- 32kcals
Radish	12	
Spinach- boiled	19	
Spinach- raw	25	1 cereal bowl (80g) 20kcals
Swede- boiled	11	1 tablespoon (27g)- 3kcals
Sweetcorn- kernels	111	3 heaped tablespoons (66g)- 73kcals
Tomato puree	76	1 teaspoon (17g)- 13kcals
Tomato puree	76	1 tablespoon (51g)- 39kcals
Tomatoes	17	1 small (85g)- 14kcals
Tomatoes	17	1 large beef (280g)- 48kcals
Tomatoes- cherry	18	1 cherry (12g)- 2kcals
Tomatoes- cherry	18	10 cherry (120g)- 22kcals
Tomatoes- sundried in oil	495	1 piece (6g)- 30kcals
Tomatoes- tinned	16	1 can (400g)- 64kcals
Turnip- boiled	12	1 tablespoon, cubed (27g)- 3kcals
Turnip- boiled	12	3 tablespoons (80g)- 10kcals
Watercress	22	1 cup (30g)- 7kcals
Watercress	22	1 cereal bowl (80g)- 18kcals

Alcohol

You can have an occasional alcoholic drink but try not to have more than ten units a week. See table 1.7 for the unit reckoner

Table 1.7 Alcohol unit reckoner

Alcohol	Unit	Calories
Glass of wine 13% (250ml/ 8 ½ fl oz)	3.3	240
Cider (568ml/ 1 pint bottle)	2.3	210
Pint of beer/ large 4% (568ml/ 1 pint)	2.3	170
Glass of wine 13% (175ml/ 6fl oz)	2.3	170
Champagne (125ml/ 4fl oz)	1.5	100
Alcopop 5% (275ml/ 9fl oz bottle)	1.4	200
Port (50ml/ 1 ¾ fl oz)	1	79
Sherry (50ml/ 1 ¾ fl oz)	1	58
Gin and slimline tonic (25ml/ 1fl oz gin*)	1	50

* A standard pub measure not home poured

Standard weights and measures:

1 Ounce	**28.35g**
1 pound	**453.6g**
1 gram	**0.0353oz**
1 Kilogram	**2.20516lb**
1 Fluid ounce	**28.41ml**
1 Pint	**568.3ml**
1 Litre	**1.76 Pints**
1 Teaspoonful	**1/8 fl oz = about 5ml**
1 Dessertspoonful	**¼ fl oz = about 10ml**
1 Tablespoonful	**½ fl oz = about 15ml**

Flavourings

Avoid adding salt to the table or when cooking. You can use the following flavourings as much as you like:

- Lemon juice
- Fresh or dried herbs and spices
- Black pepper
- Mustard/ horseradish
- Vinegars, e.g red or white vinegar, balsamic vinegar or rice wine vinegar
- Fresh or pre- chopped garlic or ginger
- Chilli- fresh, powdered or dried flakes
- Soy sauce/ low-salt soy sauce
- Miso paste
- Fish sauce
- Worcester sauce

Low- calorie drinks

Drink plenty, aim for 2 litres (4 pints) from the list below to prevent dehydration, constipation and headaches, and to keep hunger pangs at bay:

- Tea and coffee (black or add milk as required from your daily milk allowance, use xylitol (natural plant alternative to sugar or sweeteners but limit them as much as possible).
- Flavoured sugar-free sparkling water- make sure you check the label and avoid brands containing added sugar
- Sugar-free or no- added- sugar fruit- flavoured squash made up with still or sparkling water. Avoid "high juice" varieties because they contain natural fruit sugars; instead choose added- sugar varieties sweetened with artificial sweeteners
- Fruit, herbal or green teas
- Diet, sugar- free or no- added- sugar fizzy drinks
- Grated ginger in boiling water (and sweeteners as required). Drink hot or cold
- Slice of lemon or lime in boiling water

You can sweeten all drinks with artificial sweeteners. Do not add sugar.

Limit the following drinks:

- Alcohol
- Adding sugar to drinks (tea and coffee)
- Non- diet fizzy drinks
- Fruit juice (a maximum of 200ml/ 7fl oz per day)
- Vegetable juice (a maximum of 200ml/ 7 fl oz per day)

***Recipes were also given out to participants

A10- Test of Normality, Homogeneity of variance and statistics on significant differences between two diet groups on FM (kg)

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Diet	Statistic	df	Sig.	Statistic	df	Sig.
FM 1 KG	MED	.131	42	.068	.946	42	.046
	5:2	.065	43	.200*	.979	43	.610
FM 12 LOCF KG	MED	.129	42	.075	.948	42	.053
	5:2	.086	43	.200*	.975	43	.466

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Test of Homogeneity of Variance

		Levene Statistic	df1	df2	Sig.
FM 1 KG	Based on Mean	3.014	1	83	.086
	Based on Median	2.721	1	83	.103
	Based on Median and with adjusted df	2.721	1	80.190	.103
	Based on trimmed mean	2.878	1	83	.094
FM 12 LOCF KG	Based on Mean	2.907	1	83	.092
	Based on Median	2.098	1	83	.151
	Based on Median and with adjusted df	2.098	1	72.675	.152
	Based on trimmed mean	2.713	1	83	.103

A10

Test Statistics[a]

	FM 1 KG	FM 12 LOCF KG
Mann-Whitney U	693.500	691.500
Wilcoxon W	1596.500	1594.500
Z	-1.842	-1.859
Asymp. Sig. (2-tailed)	.066	.063

a. Grouping Variable: Diet

A11 Test of Normality, Homogeneity of variance and statistics on significant differences between two diet groups on FFM (kg)

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Diet	Statistic	df	Sig.	Statistic	df	Sig.
FFM 1 KG	MED	.084	42	.200*	.988	42	.922
	5:2	.087	43	.200*	.981	43	.697
FFM 12 LOCF KG	MED	.163	42	.007	.729	42	.000
	5:2	.079	43	.200*	.976	43	.500

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Test of Homogeneity of Variance

		Levene Statistic	df1	df2	Sig.
FFM 1 KG	Based on Mean	2.076	1	83	.153
	Based on Median	2.002	1	83	.161
	Based on Median and with adjusted df	2.002	1	77.304	.161
	Based on trimmed mean	2.088	1	83	.152
FFM 12 LOCF KG	Based on Mean	1.270	1	83	.263
	Based on Median	1.039	1	83	.311
	Based on Median and with adjusted df	1.039	1	52.250	.313
	Based on trimmed mean	1.049	1	83	.309

A11

Test Statistics[a]

	FFM 1 KG	FFM 12 LOCF KG
Mann-Whitney U	827.500	819.500
Wilcoxon W	1730.500	1722.500
Z	-.664	-.734
Asymp. Sig. (2-tailed)	.507	.463

a. Grouping Variable: Diet

A12- Test of Normality, Homogeneity of variance and statistics on significant differences between two diet groups on Weight (kg)

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Diet	Statistic	df	Sig.	Statistic	df	Sig.
Weight 1 KG	MED	.083	42	.200*	.977	42	.564
	5:2	.072	43	.200*	.978	43	.571
Weight 12 LOCF KG	MED	.102	42	.200*	.976	42	.519
	5:2	.091	43	.200*	.960	43	.139

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Test of Homogeneity of Variance

		Levene Statistic	df1	df2	Sig.
Weight 1 KG	Based on Mean	1.306	1	83	.256
	Based on Median	1.327	1	83	.253
	Based on Median and with adjusted df	1.327	1	79.109	.253
	Based on trimmed mean	1.295	1	83	.258
Weight 12 LOCF KG	Based on Mean	2.975	1	83	.088
	Based on Median	3.041	1	83	.085
	Based on Median and with adjusted df	3.041	1	77.551	.085
	Based on trimmed mean	2.990	1	83	.088

A12

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Weight 1 KG	Equal variances assumed	1.306	.256	-1.738	83	.086	-2.8908	1.6636	-6.1996	.4180
	Equal variances not assumed			-1.734	79.228	.087	-2.8908	1.6675	-6.2097	.4280
Weight 12 LOCF KG	Equal variances assumed	2.975	.088	-1.850	83	.068	-3.2016	1.7311	-6.6446	.2414
	Equal variances not assumed			-1.844	76.587	.069	-3.2016	1.7366	-6.6598	.2566

A13- Test of Normality, Homogeneity of variance and statistics on significant differences between two diet groups on waist (CM)

Tests of Normality

	Diet	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Waist 1 CM	MED	.087	42	.200*	.982	42	.740
	5:2	.076	43	.200*	.978	43	.553
Waist 12 LOCF CM	MED	.088	42	.200*	.969	42	.315
	5:2	.121	43	.120	.964	43	.194

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Test of Homogeneity of Variance

		Levene Statistic	df1	df2	Sig.
Waist 1 CM	Based on Mean	.933	1	83	.337
	Based on Median	.933	1	83	.337
	Based on Median and with adjusted df	.933	1	82.709	.337
	Based on trimmed mean	.891	1	83	.348
Waist 12 LOCF CM	Based on Mean	1.548	1	83	.217
	Based on Median	1.597	1	83	.210
	Based on Median and with adjusted df	1.597	1	80.287	.210
	Based on trimmed mean	1.618	1	83	.207

A13

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Waist 1 CM	Equal variances assumed	.933	.337	-2.030	83	.046	-3.0013	1.4783	-5.9415	-.0611
	Equal variances not assumed			-2.028	82.181	.046	-3.0013	1.4796	-5.9446	-.0580
Waist 12 LOCF CM	Equal variances assumed	1.548	.217	-2.059	83	.043	-3.0858	1.4988	-6.0668	-.1048
	Equal variances not assumed			-2.054	79.405	.043	-3.0858	1.5022	-6.0755	-.0960

A14- Test of Normality, Homogeneity of variance and statistics on significant differences between two diet groups on hip circumference (CM)

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Diet	Statistic	df	Sig.	Statistic	df	Sig.
Hip 1 CM	MED	.164	42	.006	.910	42	.003
	5:2	.090	43	.200*	.974	43	.442
Hip 12 LOCF CM	MED	.155	42	.013	.926	42	.009
	5:2	.201	43	.000	.639	43	.000

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Test of Homogeneity of Variance

		Levene Statistic	df1	df2	Sig.
Hip 1 CM	Based on Mean	.451	1	83	.504
	Based on Median	.256	1	83	.614
	Based on Median and with adjusted df	.256	1	82.856	.614
	Based on trimmed mean	.344	1	83	.559
Hip 12 LOCF CM	Based on Mean	.285	1	83	.595
	Based on Median	.208	1	83	.649
	Based on Median and with adjusted df	.208	1	55.792	.650
	Based on trimmed mean	.190	1	83	.664

A14

Test Statistics[a]

	Hip 1 CM	Hip 12 LOCF CM
Mann-Whitney U	647.000	645.000
Wilcoxon W	1550.000	1548.000
Z	-2.250	-2.268
Asymp. Sig. (2-tailed)	.024	.023

a. Grouping Variable: Diet